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ABSTRACT

The individual results to vocational education and training qualifications (VET) and the implications thereof for lifelong learning were examined by analyzing data from Australia's 1997 Survey of Education and Training. Private rates of return to various VET qualifications for individuals were calculated by using the internal rate of return, which is the discount rate equating the stream of incremental income from education and training with its costs. Wage regression equations were estimated to explain the full-time wages of male and female employees separately. The following were among the key conclusions: (1) individuals who complete VET qualifications generally receive higher wages than similar individuals who do not complete VET; (2) the wage effects of completing VET qualifications are higher for males than for females; (3) wages vary by VET qualification level; (4) VET qualifications provide continuing benefit to individuals throughout their careers; (5) VET study that does not lead to a qualification may have little effect on wages; (6) returns to VET qualifications are highest for those who work full time and study part time, while undertaking their course; and (7) lifelong learners who work full time and study part time enjoy modest, positive returns for further VET qualifications. Regression results and variable definitions are appended. (Contains 48 references, 30 endnotes, and 6 tables.) (MN)

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Their implications for lifelong learning

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Acronyms

ABS	Australian Bureau of Statistics
ABSCQ	Australian Bureau of Statistics Classification of Qualifications
AQF	Australian Qualifications Framework
IRR	internal rate of return
NCVER	National Centre for Vocational Education Research
SET	1997 *Survey of Education and Training Experience*
TAFE	technical and further education
VET	vocational education and training

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Executive summary

An assessment of the financial benefits to individuals of investing in vocational education and training (VET) is undertaken in this study. The methodology involves the estimation of wage regression equations using data from a representative sample of Australian employees to identify the effect of possessing a VET qualification on individual wages.

These estimated wage effects are then used in calculations of the after-tax rate of return to different qualifications for individuals in different circumstances. That is, the analysis addresses how rates of return differ for those with different levels of prior experience and educational attainment and who combine their studies with different forms of labour market participation. These estimated rates of return show the annual percentage return on the investment involved in undertaking a qualification over the remainder of an individual's career. They can be compared directly with post-tax interest rates or returns from other investments. The data used for the analysis come from the 1997 *Survey of Education and Training Experience* (1997 *SET*) conducted by the Australian Bureau of Statistics (ABS).

The study builds on the existing literature on the returns to VET qualifications in three ways. First, it contains estimates of returns to associate diploma and basic vocational qualifications when most previous studies have concentrated on the returns to apprenticeships. Second, it identifies how the estimated returns to VET qualifications vary, depending on the combination of work and study individuals engage in while undertaking their courses. Third, it takes a small step beyond the use of individuals' 'highest qualification' level as the sole description of their education and training to estimate the effect on wages of follow-up qualifications. The key results of the analysis follow.

1. Individuals who complete VET qualifications generally receive higher wages than similar individuals who do not complete VET qualifications.

Relative to their respective comparison groups, the increase in the wages of employees with VET qualifications is about 10%. That is, associate diploma graduates are paid about 10% more than Year 12 completers and basic and skilled vocational qualification graduates about 10% more than individuals who did not complete the highest level of schooling.

2. The wage effects are higher for males who complete VET qualifications than females.

The estimated wage increments are slightly higher than 10% for males and a bit below 10% for females. Other researchers have also found that VET qualifications provide better wage outcomes for males than females.

3. Wages vary by VET qualification level.

The wages of employees with VET qualifications vary between qualification levels – individuals with associate diplomas are paid significantly more than those with skilled or basic vocational qualifications. The difference is also of the order of 10%.

4. VET qualification effects provide a continuing benefit to individuals throughout their careers.

The estimated wage effects do not appear to be influenced in a marked way by any depreciation in the value of VET qualifications over time, nor do they depend on when in individuals' careers they obtained their qualifications. However, the wage-experience profile of VET graduates is considerably flatter than other individuals in the labour market, which means that their wages grow more slowly than others. This may reflect different rates or types of post-entry training that different groups of employees undertake.

5. VET study that does not lead to a qualification may have little effect on wages.

Shorter VET courses of study of up to one semester that do not lead to a qualification were not found to have a discernible impact on wages. If the costs of such courses are low, they may provide a post-tax return through an increase in wages too small to identify in a wage regression equation of the type used here. Similarly, courses individuals commenced but do not complete did not appear to affect their wages.

6. Estimated returns to VET qualifications depend critically on the work/study combination used by individuals to undertake their courses.

The estimated wage effects translate into markedly different estimates of the post-tax rate of return to undertaking a VET qualification depending on the way the individual is assumed to have completed their course. That is, the combination of work and study that an individual engages in has a substantial impact on the return they obtain from their VET qualification.

7. Returns to VET qualifications are highest for those who work full-time and study part-time while undertaking their course.

Those individuals who work full-time during their course and study part-time appear to earn quite substantial returns on their qualification. For these individuals, not only is their forgone income relatively small, they also obtain valuable full-time labour market experience while undertaking their course. Individuals who take this path to obtaining their qualification typically earn post-tax returns for their qualification in excess of 20%, with the returns even higher for basic vocational qualifications.

By contrast, individuals who undertake their courses full-time may forego substantial income in doing so. With the estimated wage effects and modest levels of student income from either part-time work or government income support arrangements, the estimated returns to this way of undertaking courses are considerably smaller. For associate diploma courses, the estimated returns are under 5% for young males and negative for young females. These estimated rates of return for individuals who adopt the full-time study mode for courses are considerably lower than those estimated for Bachelor degree graduates, which have typically been estimated to be at least 10%.

The rate of return magnitudes of the two broad work/study participation types seem quite robust to alternative assumptions made in undertaking their calculation. The estimated returns are not influenced much by modest variations in the course fees individuals are assumed to pay.

8. Those who undertake follow-up VET qualifications receive higher wages for doing so. Lifelong learners who work full-time and study part-time enjoy modest, positive returns for further VET qualifications.

Somewhat more speculatively, the labour market appears to reward at least one form of lifelong learning. Individuals who undertake a VET qualification that is no higher than some previous qualification they possess seem to receive an increase in their wages for doing so. These increased wages translate into post-tax rates of return of about 10% for 35 year old full-time employed males and females who undertake such a follow-up qualification on a part-time basis.

Some remaining uncertainties

All empirical studies are limited by the inadequacies of the available data and the methodology used to analyse that data. Some issues highlighted in this study point to areas where further work could valuably be undertaken to clarify and consolidate some of the findings of this report. The first relates to the specification of experience in wage regression equations and the finding that the wage-experience profile of VET graduates is flatter than those of other individuals in the labour market. Further work is necessary to test the robustness of this finding and to identify more satisfactory specifications of labour market experience for wage equation estimation. It is possible that the use of repeated cross-sectional data that allow identification of cohort effects might also clarify the shape of the wage-experience profile of VET graduates and others in the labour market.

If the finding that VET graduates do have relatively flat wage-experience profiles is confirmed in other work, research on the reasons underlying such a phenomenon is obviously very important. An examination of the role of the post-labour market entry training experiences of VET graduates may be very informative.

Finally, individuals chart all types of paths through post-school education and training. The use of their 'highest' qualification level to summarise their education and its effect on their wages is obviously inadequate. The small step taken in this study to use a more accurate description of the education of individuals could be valuably extended. Studies that identify the biases involved in using only 'highest' qualification would be very informative, particularly the extent of the biases attached to VET-level qualifications.

Introduction

Analyses of the wage effects of vocational education and training courses for individuals often find that their effects are modest. For example, Preston (1997) used 1981 and 1991 Census data and found that males with a 'certificate' (a trade certificate, skilled vocational qualification or associate diploma) were paid about 10% more than individuals who completed the highest year of secondary school. While estimates of this magnitude might be taken to indicate that VET education and training represents a poorer potential investment by individuals than investment in higher education, this is not necessarily the case.

The financial return on any investment is given by comparing the benefits of the investment, in this case increased wages, with its costs. In the economics of education and training literature, the main cost of education typically included in this calculation is forgone income. The direct course costs are assumed small relative to forgone income and are typically ignored in the calculation of the return.

For many individuals who undertake VET courses, these assumptions are questionable. One half of the males and one quarter of the females who completed a TAFE qualification in 1997 were employed full-time in their final semester (Tables 5b and 5c, NCVER 1998). The forgone income for those individuals who undertook courses in this manner was presumably negligible. The main costs they faced were course-related ones.

For such individuals, the modest observed wage effects give a misleading picture of the true return on vocational education and training. For example, Dockery and Norris (1996) analysed the rates of return for various forms of apprenticeship training. They found a male rate of return of 46% for all apprenticeships. However, their estimates were markedly higher in some trades and negative in others. The high rates typically reflected situations where individuals did not appear to forego any income in undertaking their training. The negative estimates reflected cases where individuals received no increment in their post-course income, compared to the unqualified wage. The aim of this study is to estimate returns for a broader range of VET courses.[1]

This study reassesses the financial benefits to individuals of investing in vocational education and training. The methodology involves the estimation of wage regression equations using data from a representative sample of Australian employees. The estimated wage effects then inform the calculation of rates of return for individuals in different circumstances. That is, the analysis sets out to answer how returns differ for those who work full-time while undertaking the qualification from those who undertake their studies full-time and/or who complete their qualifications at different stages in their working lives.

The specific research questions addressed in this project are:

1. What are the wage effects of VET qualifications, specifically for individuals with basic and skilled vocational qualifications, associate diplomas and certificates from short courses?

2. Are there significant wage effect differences between the individuals with these different VET-level qualifications?

3. How do the wage effects in the different groups translate into rates of return to VET, given the way individuals undertake courses (i.e. paid release by employer, working full-time or part-time with no assistance from employers, unemployed)?

4. How do the wage effects in the different groups translate into rates of return to VET, given individuals' experience and education and training backgrounds?

5. Does the existing reward structure for additional qualifications in the labour market support lifelong learning?

6. Are the wage effects influenced by the length of time a qualification has been held?

One by-product of the approach adopted is to determine the wage effects of skills upgrading though qualification acquisition by individuals. That is, the analysis also addresses how the labour market 'rewards' lifelong learners. While qualification acquisition is by no means the only mechanism for lifelong learning, it is an important one. Therefore, to address the fifth research question, a set of further issues of considerable policy interest is addressed. These issues include:

7. Do follow-up qualifications provide the same rewards as initial ones, and do they need to for them to be attractive?

8. Do qualifications undertaken in the middle of individuals' careers have the same payoffs as those undertaken at the outset, and once more, do they need to for the courses to be attractive?

9. Do short courses provide wage benefits? Do incomplete qualifications provide wage benefits to individuals? These questions are of considerable interest, given the growth in module rather than VET course completion by individuals in recent years.

In the next section, the current Australian literature on the wage effects of education and estimates of the private return to education is reviewed. The methodology and the data used in this project are then set out, followed by the initial regression results. Rate of return estimates based on these parameters are then presented, followed by estimated returns to (one form of) lifelong learning. Some conclusions from the analysis are drawn in the final section.

Previous research on private rates of return to VET qualifications

Estimating private rates of return to education and training

Among the reasons why individuals undertake post-compulsory education and training are that it leads to better jobs and higher pay. That is, despite its costs, individuals engage in education and training that they anticipate will lead to a more remunerative future. Analysts therefore treat these decisions as ones where individuals make an investment that involves immediate education and training costs but longer-term wage gains. How individuals compare the stream of additional future income with the more immediate costs reflects their preference for current versus future income.

The dominant economic explanation for understanding this investment is human capital theory, whereby individuals invest in their own human capital to increase their productive capacities and hence lifetime incomes. There are other explanations for the role of education of the labour market within economics, such as screening and job competition theories. However, individuals can be understood as undertaking investments in themselves in those theories also, just not necessarily in their productive capacities. In those theories, individuals' jobs and wages reflect their educational attainment relative to their peers or labour market competitors, since this conveys information to employers about either their likely ability (and productivity) and/or the costs of training them further. Therefore, individuals might be seen as investing in education and training to establish and maintain their place in the distribution of education.[2]

The analytical tool used to analyse this investment is borrowed from accounting: the calculation of the *internal rate of return* (*IRR*) of the investment in education and training. The *IRR* is just the discount rate that equates the stream of incremental income from education and training with its costs. That is, it involves the aggregation of all future additional income over the remainder of an individual's working life arising from completion of some specific education and training into some estimate in current dollars. This aggregate is compared with the total costs of undertaking the course, also expressed in terms of current dollars. The *IRR* is the discount rate that makes these aggregates equal. In the education context, the *IRR* shows the annual percentage return on the investment involved in undertaking a qualification over the remainder of an individual's career. It can be compared directly with post-tax interest rates or returns on other investments. Its calculation is described more fully in the methodology section overleaf.

Estimates of the incremental income that arise from education and training used in calculating the *IRR* are taken from some assessment of an individual's likely future income stream with and without the additional education and training. These streams are estimated over their remaining careers—the calculation requiring assumptions about individuals' retirement age. Individuals' costs of education are usually taken to include any income forgone while they undertake study and the course costs, such as tuition costs, books and equipment and any other fees.

Where individuals undertake most of their education and training full-time and prior to their entry into the full-time labour market, the major 'cost' of education is normally taken to be forgone income. The wages received by school leavers who work full-time is usually taken to represent this forgone income. If individuals work as well as undertake education and training, the difference between the wages received by school leavers who work full-time and the wage

received by those in training is taken to represent this forgone income. The 'sequential study then work' description might be taken as characterising the higher education path. The 'concurrent work and study/training' combination characterises the vocational education and training path, at least through apprenticeships, traineeships and some other forms of vocational training.

Two methods are often used to establish the incremental income from education and training over individuals' careers. The first makes use of how the observed wages of people with different qualifications differ by age or experience. That is, it uses aggregate data from some nationally representative survey of individuals and compares by how much the incomes of those with higher levels of education and training exceed those with lower levels over all ages or experience levels in the data set. It assumes that the snapshots of these wage profiles at a point in time are also likely to represent the experience of young workers over the remainder of their careers. This is the approach taken, for example, in Miller (1982), Maglen (1994) and Dockery and Norris (1996).

The second approach uses the same data sources, but estimates the education and experience effects on wages through regression analysis. This allows the analyst to control for other observed differences between those with different levels of education that might affect their wages. Moreover, in some circumstances, the analyst might attempt to control for some unobservable characteristics also. The regression parameters can then be used to estimate the wages over the careers of some 'representative' individuals to estimate their 'with' and 'without' education wage levels. Since it relies on data at a point in time, this approach also assumes that the estimated experience profile adequately represents the wage path of young workers over the remainder of their careers. This approach is taken in Willis (1986), Borland et al. (2000) and Hatton and Chapman (1989), for example.

The latter approach to estimating the effects of different levels of education and training on wages is adopted in this paper. It isolates the effect of education and training on wages from other factors that might be correlated with both and therefore allows a more accurate estimate of the true effect of education and training.

Prior research on returns to vocational education and training

There have been few Australian studies that have estimated the private rates of return to education and training. The focus of most of these has been on the return to university education – for example Chia (1991), Maglen (1994), Borland et al. (2000). Australian studies that have estimated rates of return to forms of vocational education and training include Miller (1982), Hatton and Chapman (1989), McGuire (1994) and Dockery and Norris (1996).

More commonly in Australia, researchers have estimated wage equations that include variables that capture completion of education qualifications, including vocational education and training qualifications. A number of these studies are summarised, in conjunction with others that have estimated rates of return to education, since they provide some idea of the effect on wages of increased education and training. Such an effect is obviously a pre-condition for vocational education to possess a positive return. Among those general wage regression studies, most emphasis is given to those wage regression studies that use data sets similar to the one used here.

For the purposes of presentation, this literature is grouped around three broad headings, involving: (1) studies that estimate private rates of return using empirical education – experience or age profiles; (2) studies that use wage regression equations that focus on estimating the effects of VET qualifications on wages; and (3) studies that use wage regression equations that estimate the effects of education and training qualifications more generally on wages. After discussing these studies, some unresolved issues in the literature are described, along with a summary of some the key findings in these studies for this research.

Studies that estimate private rates of return

Miller (1981, 1982) used empirical age-earnings profile from the 1976 Census to estimate rates of return to various forms of education and training. Miller (1981) reported very high rates of return to Trade qualifications in 1976, substantially above those found for those with university degrees. The reported estimates for 15 and 16 year old males (the common commencement ages at that time) who took up apprenticeships all exceeded 50%, while the female rates for the same ages were all positive.

Dockery and Norris (1996) undertook a similar analysis with the 1991 Census. In addition to estimating returns for trade qualifications in aggregate, Dockery and Norris (1996) estimated the return for selected trades. The earnings of the trade groups were compared with those of individuals of the same sex without post school qualifications. The aggregate male return was 46%, while females with trade qualifications earned less than those with no post school qualifications, in aggregate and for two of the three occupations examined. Some male trades were also paid less than those without post school qualifications, though in most trades the return was positive and in excess of 25%. In one trade, apprentices earned more than those without post school qualifications, so that the return to the trade qualification was infinite. Taken as a whole, the analysis highlights the difficulty of identifying the correct alternative wage for calculating forgone income for the rate of return calculation.

McGuire (1994) adopted a slightly different approach. McGuire used the pay structure in metal trades to construct a series of estimated rates of return. The rates of return were calculated by comparing the weekly pay of apprentices who were assumed to complete a four year apprenticeship and then become base grade tradespersons with unapprenticed juniors who became adult process workers at age 21 (in accord with the award). Due to data limitations, McGuire assumed that apprentices and junior process workers received only award rates, while adult workers also received overaward payments. McGuire estimated post tax rates of return to apprenticeship training in metal trades of between 21.4 and 13.5 between 1955 and 1990, though most estimates were around 15%.

Wage regression results with a focus on VET level qualifications

Long and McKenzie (1996) estimated the increment to weekly wages of various forms of post school qualifications, including VET qualifications. Of note for this paper, is that they used the 1993 ABS *Survey of Training and Education*, the predecessor to the collection used in this paper. Long and McKenzie (1996) estimated wage regression equations over all full-time employees aged 20 to 64 at the time of the survey. Separate equations were estimated for males and females.

Long and McKenzie (1996) found that VET level qualifications were associated with increased wages. In their equations that included the most controls for individual and job characteristics, associate diplomas were associated with increased wages of about 10 and 7% for males and females above those of individuals who left at or after age 16, but did not complete high school. These wage rates were also about 7 and 3%, respectively, above the wages of those who completed school but undertook no further education and training. Skilled vocational qualifications were associated with increased wages of about 5 and 12% for males and females, while wages for males with basic vocational qualifications were 5% higher than the group that remained at school beyond the compulsory age, but did not complete school. These wage rates were close to those of Year 12 completers, except for females with skilled vocational qualifications, which were 7%higher.

Hatton and Chapman (1989) estimated the effect of trade training on wages with a regression equation using data from the 1973 social mobility survey. The data covered full-time male workers aged between 30 and 65. They found that trade qualifications did not significantly increase individual wages, but that other post school qualifications did. Hatton and Chapman concluded that 'even when the relevant costs are taken into account, the rate of return on apprenticeships and trade training was probably no higher than other forms of post-school training and may have been lower' (1989:149).

Lamb et al. (1998) used data from longitudinal data sets, the *Youth in Transition* and the *Australian Youth Survey*, to analyse participation in vocational education and training and some of its outcomes. They also compared the data from the longitudinal collections with the 1993 ABS *Survey of Training and Education*. Lamb et al. (1998) estimated average weekly earnings regression equations for 24 year old full-time workers.

For the mid 1990s, they found that males with TAFE Diplomas and those who completed apprenticeships earned 10 to 11% more than male 24 year olds who had completed Year 12, but not undertaken any post school education or training.[4] Those with TAFE Certificates earned 7% less than Year 12 completers. Male Year 12 completers earned just 2% more than individuals who completed Year 10 only.

The wage benefits for females from VET qualifications were lower. Diploma and Certificate holders earned 2 and 8% less, respectively, than female 24 year olds who had completed Year 12, while those who completed apprenticeships earned 2% more. Female Year 12 completers earned 9% more than individuals who completed Year 10 only.

Lamb et al. (1998) also identified differences in wages by field of study and type of apprenticeship for those 24 year olds with VET qualifications. Those males with 'science' and 'architecture, building and engineering' qualifications earned above average wages, as did those with metal, building and electrical trade qualifications. Females with 'services, hospitality' qualifications earned slightly above average wages. Lamb et al. (1998) also found that individuals who undertook work-based training in various years enjoyed larger future income growth than those who did not.

Wage regression results from other studies

Chang and Miller (1996) estimated an hourly wage regression for individuals utilising the 1991 Australian Census. Individuals' education was captured through a continuous, years of schooling variable. The estimated average increment to wages associated with an additional year of schooling was 4.7%.

Preston (1997) reported the results from the estimation of male weekly wage equations based on data from the 1981 and 1991 Censuses. Preston condensed individuals with basic and skilled vocational certificates and those with associate diplomas into just one educational category in the estimates. In both years, males with those qualifications earned 20 to 25% more than males who did not complete high school, and about 10% more than those who completed high school. These magnitudes reflected differences between males with varying educational levels in the public and private sector also.

Budd and Madden (1999) estimated a model of Australian full-time hourly wages using the Australian Bureau of Statistics' 1990 *Survey of Income and Housing Costs and Amenities*. They found that males with a VET qualification earned about 4% more than those who completed high school and 8.5% more than those who did not. Females with a VET qualification earned about the same as those who completed high school and 4% more than non-completers.

Miller and Mulvey (1997) estimated an hourly wage equation and found that males with Trade qualifications earned 10% more than males who left school before age 15, but only marginally more than those who completed high school. Those with other post secondary certificates (undergraduate and associate diplomas) earned 5 to 8% more than those with Trade qualifications. Miller and Mulvey found that females with Trade qualifications earned about 12% more than females who left school before age 15, and about 6% more than those who completed high school or who completed a 'post secondary certificate'. The authors used data from the 1993 ABS *Survey of Training and Education* for their analysis.

In another study using the same data, but with a larger number of demographic and job characteristic controls, Miller and Mulvey (1996) found lower education effects on hourly wages. In that study, males with Trade qualifications earned 7 to 8% more than males who left school

before age 15, and 3 to 4% more than those who completed high school. Those males with other post secondary certificates earned 2 to 3% more than those with Trade qualifications. Females with Trade qualifications again earned about 12% more than females who left school before age 15, but also about 10 to 12% more than those who completed high school or who completed a 'post secondary certificate'.

Miller et al. (1997) estimated an hourly wage equation using data from the 1991 Census. Individuals' education was captured through a continuous, years of schooling variable and a dummy variable for those with a post school qualification. The coefficient on the years of schooling variable ranged between 3.8 and 7.2%, indicating the effect of an additional year of schooling on wages. The coefficient on qualifications dummy was between 2.6 and 4.5%, which provides an estimate of a one-off increase in wages for individuals with any post school education.

Marks and Fleming (1998) used the *Youth in Transition* survey to analyse the earnings of young people with different levels of education and training. They analysed the experience of three cohorts of young Australians. They analysed hourly earnings over the entire time the cohorts were followed. They found that completion of an apprenticeship increased hourly earnings, by 6% for the cohort followed for the longest time (and hence, to the oldest age, 33) and by 16% for the cohort followed to age 24. Completion of TAFE certificates and diplomas did not affect hourly earnings in a consistent manner, having a positive effect for some cohorts and negative for others. Marks and Fleming (1998) also analysed earnings at different age ranges (18 to 22, 23 to 27 and 28 to 30 or 33 years) for the cohorts. They found that the measured positive apprenticeship effect on wages fell with age and was not statistically significant for the oldest groups in all the cohorts. The TAFE certificate and diploma effects followed a similar pattern of decreasing importance with age. Consequently, the authors concluded that such qualifications were of 'little long-term advantage' (1998: *v*).

Borland et al. (2000) report the results of a wage regression equation for male weekly earnings in their current jobs that uses the 1997 *Survey of Education and Training Experience*, the same data set used here. The equation was estimated over employed males (full and part-time) aged 18 to 59. Their estimates suggest that those with 'certificate/diplomas' earned about 13% more than Year 12 completers.[5] Those with trade qualifications earned marginally less than Year 12 completers (3% less, but it was not significantly less), but they earned significantly more than non-completers of school (14% more). The focus in the paper was to estimate the rate of return to a Bachelor's degree compared with those who completed only Year 12. The post tax private rate of return on a degree was estimated at between 12 and 15%. When the better employment rates of individuals with Bachelor's degrees were taken into account, the estimated return rose by 5 to 7 percentage points.

Some uncertainties

The studies described in the previous two sub-sections typically seem to support the idea that VET qualifications have a small positive effect on male earnings, but that their effect on female earnings is less clear. Two problems that affect such studies might encourage caution about such conclusions, however. The first relates to the quality of the data available for such studies, and the second to the adequacy of the specification of the regression equations that lie behind such estimates.

At least three issues affect the quality of the data used in these studies. The first is that the data often only contain the highest qualification of individuals. For example, the VET-level qualifications of individuals with university qualifications are not identified, nor are multiple qualifications at the same level nor subsequent qualifications completed at a lower level than the highest ones of individuals. Little is known about the magnitude of the bias such mis-measurement of educational qualifications might cause. However, results reported in a subsequent section that incorporate the effect of follow-up qualifications for individuals that were no higher than a previous one suggest the bias from ignoring those qualifications, at least, is modest. The second data issue is that cross-sectional data consist of cohorts of individuals whose

current labour market outcomes (wages in this case) reflect their accumulated experiences of differing, prior labour market conditions. Such data do not allow unique cohort effects to be distinguished from the general effect of labour market experience. This issue is discussed in the next section. The third data issue is that the actual labour market experience of women is rarely recorded in available data and conventional estimates are likely to overstate it because of labour market interruptions associated with child-rearing. However, Rummery (1992) presented results with experience and potential experience alternately included in a wage regression equation for females. The parameter estimates for both experience and educational qualifications are almost identical in the two sets of results.[6] Therefore, Borland et al. (2000) concluded that Australian 'studies do not seem to find a significant difference in estimates of the return to schooling where potential and actual experience are used as alternative explanatory variables' (2000: 53). A limited exploration of this issue is undertaken in the next section.

On the issue of the adequacy of the regression specification, all of the studies discussed in the previous two sub-sections have been estimated by some form of least squares regression analysis. None took any account of the role of individual self-selection in educational choice. Vella and Gregory (1996) is one Australian study that takes account of self-selection. They used data from the *Australian Longitudinal Survey*, a longitudinal survey of young Australians. They found that corrections for self-selection increased the wage effects of education and training. The estimated effect on wages of Year 12 students completing a 'diploma' rose from 15% to 23%. The authors also allowed other individual and job characteristics to have different effects for those with different levels of education. When they took account of those differences, Vella and Gregory (1996) found that the wage effect of completion of a 'diploma' was lower, at 9%. On the face of these results, the estimated wage effects of education and training can be quite fragile to the assumptions made in undertaking the analysis.

Another point of some note is that all of the studies that use large data sets discussed in the previous sub-section are beset by a technical problem known as 'heteroskedasticity'. In regression equations, the purpose is to describe the relationship between some variable, in this case wages, and a set of observed explanatory variables. An analyst's ability to do this is influenced by the properties of that part of the dependent variable that are not explained (the 'error' or 'residual' of the regression equation).

Analysts hope that this error is 'random', which makes it more straightforward to draw inferences about the hypothesised relationships. Randomness means that the error contains no elements that have a systematic effect on the dependent variable. A random error term will generally have a set of 'desirable' properties.

One of those properties is that the error term should be 'homoskedastic', that is it should have a constant variance. If the variance of the error terms is not constant, this may cause the analyst to use inappropriate standard errors to determine the significance or otherwise of parameter estimates. In general, this can be overcome in a quite straightforward manner through the use of 'corrected' standard error estimates.[8] This has been done routinely in the studies discussed above.

However, the extent of the heteroskedasticity in these studies is substantial. The reported test statistics used to assess the extent of heteroskedasticity are extremely large.[9] Heteroskedasticity can arise because the estimated wage equation is misspecified in some fundamental way. For example, the explanatory variables in the form they enter the equation may not capture some non-linearity in the dependent variable. In this case, the heteroskedasticity may reflect the non-random nature of the errors because something else that has a systematic effect on the dependent variable has been omitted from the equation. Therefore, it may be that the magnitude of the test statistics in the literature point to more substantive problems with the form of estimated wage equations. Indeed, Miller and Mulvey (1996) identify such a problem where they report that their preferred equations failed RESET specification tests. The RESET test is useful in identifying both misspecified functional form and the omission of important explanatory variables from the estimated equations. Despite the failure of specification test, Miller and Mulvey retain the estimates from the standard Mincer earnings function since 'It is not clear from the literature, however, that a better specification exists, given the limitations on the data.'

(1996: 110) The problem remains, however, that if the equations are misspecified, neither the magnitude nor the direction of any biases in the estimated parameters are known, which would justify considerable caution in interpreting estimated parameters from wage equations.

Other problems have been identified with the standard Mincer earnings function, notably in relation to the quadratic form of the experience variable (that is, its effect is captured in the equation through two terms: experience and experience squared). Both Murphy and Welch (1990) for the United States and Borland and Suen (1994) for Australia have demonstrated that higher order experience terms should be included in wage equations to capture accurately the shape of experience-earnings profiles.

These various question marks over the exact form of the estimated wage equation should not detract too much from the approach adopted.[10] Card (1999) reviews the approach embodied in the Mincer earnings function and concludes that it remains a valuable vehicle for analysing differences in individual wages. The sentiments expressed in Miller and Mulvey (1996), that no obvious alternative specification exists at this time, are not unreasonable ones. The issues, however, highlight the need to ensure that the estimated education, training and experience effects on wages are robust to alternative specifications before proceeding to use them to estimate rates of return to education and training in Australia.

Implications and conclusions from the literature

Based on the various studies discussed above, it seems reasonable to conclude that VET qualifications have a small, positive effect on male wages compared with early school leavers and, possibly, those who complete Year 12. It is less clear that there are significant wage differences between males with different level VET qualifications, though it is possible that those with associate diplomas earn more than those with other qualifications. For females, the wage effects of qualifications other than associate diplomas are less pronounced.

Some variability in the estimates appears to reflect the specification of VET-level qualifications in the data used by analysts. Results that use the recently superseded ABS qualifications framework indicate that associate diplomas and skilled vocational certificates have a positive effect on wages, while the effect for basic vocational certificates is negligible. Previous findings that used categorisations that involved the combination of associate diploma level qualifications with basic vocational certificates often generated conclusions that such 'certificates' had little effect on wages, while finding a small effect for males with trade qualifications.

Since higher levels of education and training result in both higher skilled jobs and increased wages, studies that include more variables that capture characteristics of the jobs people do (occupation, sector, firm size, for example) result in lower estimated returns to education and training. When these variables are excluded, the estimated education effects capture both access to high skilled jobs and education effects on wages within job skill levels.

The move from regression wage effects to the estimation of private rates of return involves a number of critical decisions. Among these decisions is the identification of the appropriate comparison group or groups. These comparisons affect both the measurement of forgone income and incremental lifetime income associated with the increased wages arising from additional education and training.

With modest estimated wage effects for VET qualifications, the estimated private return will depend critically on the wages individuals forego in undertaking their courses. Where this is minimal, as in the case of apprenticeships, traineeships and other pathways that involve joint employment and formal training, the returns are likely to be quite high. Modest wage effects for individuals who are not employed when they undertake a VET course mean that their returns from such an investment may be quite low.

Methodology and data

Methodology

The methodology pursued in this project involved the steps described below.

First, wage regression equations were estimated to explain the full-time wages of male and female employees separately.

These equations include the usual set of controls for individual and job characteristics used in Australian wage studies, such as those described under the third heading in the previous section. These variables include estimated experience (plus higher order terms), birthplace, English language ability, marital status, hours worked, duration in the job or occupation, employer size and sector. Initially, the highest educational qualification of individuals is used to describe their education. This approach should produce estimated education, training and experience effects on wages that are comparable to those found in other Australian studies. Analysis in a later section relaxes this reliance on highest qualification level by including additional variables to capture the effect on wages of completion of subsequent education qualifications by individuals that are no higher than one they already possess.

The analysis utilised data on employees. While VET qualifications may also affect the incomes of employers and the self-employed, self-reported income data for these groups are notoriously poor. Moreover, the income information on these groups in the data set used here is aggregated into quite a small number of intervals (six). Exploratory analysis of the determinants of the income of those groups via regression equations did not generate very satisfactory results and was not pursued further.

Second, a series of specification tests were undertaken to determine whether the estimated equation and its parameters were satisfactory. In particular, alternative specifications were investigated in order to determine how robust to variations in specification were the estimated education, training and experience effects. The problems associated with the mismeasurement of experience and the effect this has on the parameter estimates of the female equation is addressed in discussion of the results.

Third, once a satisfactory specification was identified, a series of variables were added to the regression equation designed to address the specific research questions of this study. These variables incorporated issues such as how long a qualification was held and when in their careers individuals undertook them, along with the effect of short courses that do not lead to qualifications.

Fourth, these various estimated education, training and experience effects on wages were used to estimate private rates of return to VET qualifications for individuals.

Calculation of the rate of return for individuals

As described earlier, the analytical tool used to estimate private rates of return to various VET qualifications for individuals is the *internal rate of return* (*IRR*). The *IRR* is the discount rate that

equates the stream of incremental income from education and training with its costs. It involves the aggregation of all future additional income over the remainder of an individual's working life arising from completion of some specific education and training into some estimate in current dollars. This aggregate is compared with the total costs of undertaking the course, also expressed in terms of current dollars. The *IRR* is the discount rate that makes these aggregates equal. Its calculation is described more fully below.

Calculation of rates of return to education and training (adapted from Industry Commission 1997)

Let the discounted value of the benefits (PV_b) and costs (PV_c) of a VET qualification be given by:

$$PV_b = \sum_{t=0}^{a-e} [(W_{qual} - W_{noqual})/(1+r)^t]$$

and

$$PV_c = \sum_{t=0}^{t-1} [\{(W_{noqual} - W_{student}) + c\}/(1+r)^t]$$

where

- W_{qual} annual after tax income for persons with a specific VET qualification
- W_{noqual} annual after tax income for persons in the relevant comparison group who have no VET qualification
- $W_{student}$ annual after tax income for persons undertaking a qualification
- t number of full-time equivalent years to complete the qualification
- t time
- a retirement age, assumed to be 65 years
- e age when individual completes the qualification and enters the labour market
- c direct costs associated with completing the VET qualification, including fees and material charges
- r the discount rate

The *IRR* is that value of r for which $PV_b - PV_c = 0$.

Since both the stream of benefits and costs are discounted, greatest weight in the calculation of the *IRR* is given to immediate costs and benefits of the education and training. These include the costs of completing the qualification (forgone earnings : $W_{noqual} - W_{student}$ and direct course costs, c) and the early post-course wage differential between graduates and the comparison group : $W_{qual} - W_{noqual}$.

A point to be emphasised about the *IRR* is that it is an estimate of the return provided by a stream of incremental income *given* the amount invested (the costs of obtaining the qualification). That the estimated *IRR* from some qualification exceeds that of another does not imply that it produces a higher lifetime income stream – the costs of obtaining it may be lower. Ranking potential courses of action on the basis of their *IRR*'s only makes sense where they have similar costs.

The *IRR* approach requires a number of simplifying assumptions. The most obvious one is that only the financial benefits and costs of the course of study are considered in the calculation. Education and training clearly provides a range of other individual benefits, but since these benefits are generally difficult to quantify, they are ignored here as elsewhere. However, education and training qualifications convey other labour market advantages by increasing the probability of individuals working full-time and in providing access to more stimulating and rewarding jobs in skilled occupations. Therefore, as in Borland et al. (2000), the rate of return estimates presented here for graduates who undertake their qualifications immediately after

completing school reflect the differing probabilities that individuals with different level qualifications are employed. For those individuals assumed to undertake their course while working full-time later in their careers, the calculations assume that they are always employed, which seems more likely to match the assumptions the individuals would have about their own futures.

Education provides both access to high skilled jobs and affects wages within occupations and job types. This latter effect is the productivity effect studies often aim to isolate by including controls for occupation and other job characteristics to account for the access effect. However, both effects determine the private benefits conveyed by a qualification to individuals. Therefore, in this study, occupational controls are not included in the preferred wage equation, so that the VET qualification effects include a component that reflects the better occupational distribution of graduates compared to non-graduates.[11] The sensitivity of the estimated rates of return to the exclusion of occupation and other labour market characteristics that might reflect the 'match' between employees and firms elements that education affects is assessed in a later section.

The second simplifying assumption is that the wage regression results reported in the next section provide sound estimates of the post-course wage differential between graduates and the comparison group - $W_{grad} - W_{nograd}$ - at every point in individuals' post-course careers. There are a number of reasons why this might not be so. The first is that wage-experience profiles estimated from data collected at one point in time, like that used below, may not provide an accurate representation of the experience of cohorts as they age. For example, Chia (1991) showed how wage-experience profiles estimated from cross-sectional data could mis-represent the experiences of cohorts as they aged.[12] He found that while estimates of the return to a university degree based on cross-sectional data to the mid-1980s indicated that the return had fallen over time, cohorts of recent graduates enjoyed similar wage advantages over their less educated peers as had their predecessors. The analysis of the experience of graduate cohorts therefore pointed to no deterioration in their position relative to their peers. More recently, Borland and Kennedy (1998) found that age-earnings profiles have been stable in Australia over the 1980s and 1990s. In that case, the wage-experience profiles estimated from cross-sectional data should match the experiences of cohorts, so that any induced biases for the rate of return estimates from the use of cross-sectional data are likely to be small. Nevertheless, the importance of the issue justifies further analysis to test this result.

A second reason why post-course wage differentials might be a poor guide to the 'pure' qualification effect on wages is that estimated qualification effects generally incorporate a host of other factors that researchers cannot isolate. These factors affect both the qualifications individuals obtain and their eventual wages. They include ability and other factors that influence individual self-selection of their education level, which mean that those who obtain qualifications may differ systematically from those who do not, but these differences are not unobserved by analysts. Ability bias effects have typically been found to be modest (for example, Karmel 1995), while studies that attempt to incorporate self-selection find that the estimated wage effects tend to be too small (for example, Vella and Gregory 1996).

A third set of important assumptions relates to the forgone income of individuals while they undertake their studies. The assumption used in calculations here varies depending upon the mode of study assumed to be undertaken by students. Where estimates relate to full-time VET studies, the forgone income of students is estimated as the difference between the full-time post-tax wage of individuals of a similar age from the comparison group and the income of VET students. This income might consist of wages from part-time work or from student income support provided by the Commonwealth government. Estimates of the wages of the comparison groups and the income from part-time work for young people are taken from the 1997 *SET* data. The income support rates are based on the 'standard' 1997 AUSTUDY rates relevant for young people aged under 18 or 18 and over, depending on the circumstances of the hypothetical individual for whom the calculation is made. The 1996-97 tax rates are used in all estimated rates of return. Where estimates relate to the part-time VET studies of students who work full-time other than apprentices, the forgone income of students is assumed to be five% of the income they could otherwise earn. In the case of apprentices or those with skilled vocational

qualifications, their estimated forgone income is given by the difference in the post-tax wages of individuals presently undertaking such courses in the data and those working full-time of a similar age from the relevant comparison group, again estimated from the 1997 *SET* data.

Obviously, in calculating both forgone income and post-course wage differentials, identification of the correct comparison group for different types of VET graduates is critical. For the most part, comparisons are made between VET graduates with associate diplomas and other individuals who have completed school, but not any post-school qualifications. Completion of Year 12 or of Year 10 in conjunction with a related certificate course are common pre-requisites for entry into associate diploma courses. Individuals with basic and skilled vocational qualifications are compared with those who did not complete their schooling. While many young people now enter at least skilled vocational qualifications having completed their schooling, this is generally not a pre-requisite and the data set used here contains many individuals who commenced apprenticeships, for example, without completing the highest level of school.

Table 1 contains background information on the way VET students tend to undertake their courses, using the classification of qualifications from the 1997 *SET* data set described in the next sub-section. The first panel of table 1 contains some summary information about weekly hours of study by VET graduates, their ages and their employment status at different times. The data are taken from the 1997 TAFE graduate destination survey (NCVER 1997).[15] Key features of this summary are that: skilled vocational and associate diploma graduates tend to be younger than basic vocational graduates; and that skilled vocational graduates were more likely to undertake their courses on a part-time or block or day release basis than other graduates. Skilled vocational graduates were more likely to be working during their courses and about a third of them were employed before, during and after their courses by the same employer. One quarter of the graduates of other courses had similar employment stability. These features of participation in VET are used to shape the participation patterns assumed in the calculation the rates of return to VET qualifications presented below. The stability of employment for such a large proportion of VET students, for example, suggests that for many graduates their forgone income from undertaking their course is likely to have been minimal.

The final set of important assumptions relate to course costs. VET course costs vary substantially between course types or level, jurisdictions, provider types and between institutions. In addition, concessional rates typically apply to individuals in receipt of social security payments such as the *Youth Allowance*. On the basis of a Web search of the fees charged by institutions and estimates in Borthwick (1999), fees for full-time, full-year students who pay full course costs appear to lie between $500 and $1000 per annum in 2001. Many courses also involve additional materials and resource costs of up to $200 (and sometimes additional charges for first year apprentices and trainees). Costs of these magnitudes are built into the estimated rates of return figures, with the course costs applied on a pro-rata basis for part-time students and anyone assumed to be unemployed prior to undertaking their course.

These issues and a number of others that require resolution to estimate private rates of return for individuals are summarised in table 2, along with the approach adopted in this paper.

Table 1: Background information on VET student course and employment participation, education levels of the population and wages by qualification level, 1997

	Highest qualification level				
	School study only		VET qualifications		
	Not completed Highest level		*Basic voc*	*Skilled voc*	*Associate diploma*
Graduate characteristics					
Weekly class hours (%)					
Hours 1 to 15			49.0	50.1	40.1
Block or day release			2.9	15.9	1.0
Hours 16 or more			44.1	31.0	54.0
Age (%)					
Aged 15 to 24			36.0	45.4	46.0
Aged 35 to 45			36.1	29.9	29.4
Employment status (%)					
Same employer before, during and after course			24.5	34.6	24.3
Employed in last semester of course			50.1	72.8	67.0
Qualifications, employment and wages					
Highest education level (%)					
male	28.5	13.4	9.4	20.9	4.7
female	27.4	13.9	15.8	2.5	5.1
Estimated probability of being employed (%)					
male	85.4	88.6	87.7	92.4	92.6
female	72.8	79.5	79.9	82.6	83.3
Average weekly wages of full-time employees ($)					
male	599	660	709	704	796
female	508	541	526	534	590
VET qualification wages relative to comparison groups[a] (%)					
male			18.4	17.6	20.6
female			3.5	5.1	9.2

Source: NCVER (1997) and 1997 SET data.

(a) The wages of individuals with basic and skilled vocational qualifications are compared with those who did not undertake the highest level of secondary school. The wages of those with associate diploma graduates are compared with those who completed the highest level of school.

Table 2: Resolution of issues in the calculation of rates of return to VET qualifications

	Issue	Resolution
1	Qualifications do not only increase individual wages. How are their effects on the probability of employment and the types of occupations people work in reflected in this analysis?	Rate of return estimates are adjusted by the probability of working for individuals. Since occupation is excluded from the wage equation, the qualification effects include a component that reflects the occupational distribution of graduates.
2	Do estimated qualification effects on wages based on cross-sectional data provide a sound basis for estimating lifetime earnings profiles?	The evidence from the 1980s and 1990s does not suggest that using cross-sectional data induces significant biases. Following Miller (1982) and Borland et al (2000), real earnings are assumed to grow by 2% per annum in line with productivity.
3	The estimated qualification effects on wages may be biased because they may reflect	
3a	• unmeasured ability effects	These are typically estimated to be modest and offset by self-selection effects. However, the convention of assuming that 20% of the qualification effect reflects ability is followed here, for both wages and the probability of employment.
3b	• education's screening effect	This component is legitimately included in estimates of private returns to individuals.
3c	• self-selection by individuals	The presence of self-selection effects is tested in the wage regressions.
3d	• average returns to graduates, rather than the returns to 'marginal' decision-makers.	The sensitivity of the estimated rates of return to variations in the qualification effects on wages is discussed.
4	What are the appropriate comparison groups for individuals with VET qualifications?	Associate diploma graduates are compared with school completers. Basic and Skilled vocational qualification graduates with non-completers of school.
5	What earnings do VET students forgo during their studies?	Part-time students who work full-time forgo 5% of the income of their comparison group. Full-time students and apprentices forgo the difference between the post-tax full-time wage of their comparison group and their earnings from any work they undertake or AUSTUDY if they receive it.
6	What assumptions should be made about how long individuals take to complete their VET courses?	Individuals take the following full-year equivalent time to complete courses: one year for basic vocational courses, two for associate diplomas, and two for skilled vocational courses.
7	What fees do VET students pay for their courses?	$500 to $1000 for full-year, full-time non-concessional students.
8	What other direct course costs must VET students pay?	Up to $200 in materials charges.

Data used in this analysis

The data used in this analysis are drawn from the 1997 *Survey of Education and Training* (*SET*) conducted by the Australian Bureau of Statistics (ABS 1998). The dwellings-based survey involved contact with over 30,000 individuals and yielded 22,704 completed interviews. It was conducted over a six week period from March 1997.

The information collected from individuals included detailed education, training and labour market history, as well as information on present forms of participation in those activities. The

data also included some socio-demographic information, along with information about the job characteristics of those presently employed.

The strength of the data set for the purposes of this analysis lies in the extensive information it contains on individuals' educational attainment. Individuals reported details on their three highest post-school qualifications, as well as the age at which they left school and whether they had completed the highest level of schooling possible. The qualification details included the provider type, when the qualification was completed, its field and level. Similar information on qualifications individuals failed to complete in recent years, or on short courses that did not lead to qualifications, were also collected in the survey, along with material on present courses of study.

Qualifications in the survey were coded using the ABS Classification of Qualifications (ABSCQ). Its structure includes both field of study and level of attainment elements. The VET-level qualifications in the level of attainment classification are treated in this study as including (at the time of the surveys, at least):

- associate diplomas – which covered VET associate diploma and advanced certificate level qualifications;
- skilled vocational qualifications – which covered apprenticeship and trade certificates; and
- basic vocational certificates – which covered pre-apprenticeship and pre-vocational courses, other certificates and traineeships. This category is meant to include courses designed to provide the skills necessary to operate as operatives in occupations.

The proportion of male and female full-time employees whose highest qualification was one of these VET-level ones are reported in table 1. The most common VET qualification held by males is a skilled vocational one, with just over one fifth of the full-time male workforce holding such a qualification. The VET qualification most commonly held by females is a basic vocational qualification. The average wages of full-time employees in the *SET* data by educational attainment are also shown there. They suggest that full-time employees with VET qualifications earn more than individuals with lower levels of educational attainment, with the differentials being considerably larger for males than for females.

First stage regression results

Summary of the regression results

Wage regression equation results are reported in table A.1 of appendix A. The results accord with those of the studies described in the review of the literature, so little discussion is given to the estimates other than those parameters that measure the wage effects of completion of VET qualifications. The definitions of all variables used in the analysis appear in Appendix B. The specification uses the highest education qualification of individuals, ignoring any prior or subsequent lower level qualifications individuals might possess, a limitation relaxed in analysis reported in a subsequent section.

The results are summarised in table 3, which contains the percentage wage increase among full-time employees associated with a given VET qualification over some lower level of educational attainment.[14] For example, the middle two columns of the first line show by how much the wages of males and females with associate diplomas exceeded the wages of people of the same gender who did not complete the highest level of secondary school. For males, people with associate diplomas earned about 25% more than males who did not complete school. Where there are zero entries in the columns, this means that the estimated wage differences were not statistically significant.

Table 3: Summary of wage regression results: significant VET qualification effects

VET Qualification	% higher than		Alternative qualification
	Males	Females	
Associate Diploma	25.9	20.5	School non completers
	9.4	7.8	School completers
	10.3	12.2	Basic vocational
	10.7	10.5	Skilled vocational
Skilled vocational	13.8	9.2	School non completers
	0.0	0.0	School completers
	0.0	0.0	Basic vocational
Basic vocational	14.1	7.3	School non completers

Source: regression coefficients reported in Table A.1. The equations were estimated over male and female full-time employees separately.

Table 3 supports previous findings that VET qualifications provide better wage outcomes for males than females, with the estimated parameters for males with VET qualifications generally being higher for males than females. The magnitudes of the effects are also in line with previous studies that used similar data sets, such as Preston (1997), Budd and Madden (1999), Miller and Mulvey (1997) and Borland et al. (2000).

For both genders, individuals with basic or skilled vocational qualifications earned higher wages than those earned by individuals who did not complete school. The wages of individuals with

basic or skilled vocational qualifications tended to be slightly lower than the wages earned by those who finished secondary schooling without completing any post school qualifications.

Associate diploma graduates earned more than individuals with basic or skilled vocational qualifications or those who finished secondary schooling without completing any post school qualifications.

Adequacy of the specification

While the estimated wage regression coefficients match those commonly found in the literature, the regression equations behind table 3 are not entirely satisfactory. Just as typically, the error terms of both equations are heteroskedastic, with the test statistics very large. Consequently, the 't statistics' in table A.1 are based on White's heteroskedasticity consistent standard error estimates.

The male equation failed the RESET specification test. As previously noted, the RESET test may pick up either some functional misspecification or the omission of an important variable. Since the regression equation contains the type of explanatory variables commonly found in such wage equations, it seems likely that some misspecification, rather than the omission of an important variable, is the cause of the failure of the RESET test.

One possibility is that the cause of the misspecification arises from the grouped nature of the wage variable in the data set. The data set only contains the intervals within which employees' wages fell ($680 to $720 per week, for example). The top interval was $1160 and above, which is quite low and this may affect the least squares parameter estimates. Quite a large proportion of male employees, about 12%, was in this top category.[15]

About 2.5% of females were in the top wage category, which would suggest that the degree of misspecification would be more pronounced in the male equation than the female one if this censoring of the data is a problem. Indeed, the female equation survived the RESET test.

In fact, the estimated VET qualification effects on wages were quite consistent across a series of alternative specifications for the wage equation for both males and females. These estimated qualification effects from the alternative specifications are summarised in table A.2 of Appendix A. The alternative specifications dealt with three problems that might cause the results to be unreliable: the censoring of the top income category[16, 17]; the possibility that the estimation of the regression equation over disparate groups of individuals in the labour market biased the results[18]; and the degree of heteroskedasticity exhibited in the data.[19] None of the alternative regression approaches generated results for the VET qualification effects that differ substantively from those of the base case.[20]

A further potential problem is that individuals who choose particular actions, such as undertaking a VET qualifications or are chosen for particular activities, such as working full-time, may differ in ways not captured in the data set used here. In those circumstances, selection of or by individuals of that activity muddies the true relationship between the activity and some other outcome. Specifically, self-selection, means that the wage outcomes achieved by individuals with specific qualifications may not provide a good guide to the outcomes other individuals would achieve if they acquired those same qualifications. Tests were undertaken for forms of selection bias in alternative specifications of the wage regression equation. These allowed for selection effects arising from full-time work effects and education and training qualification effects. The first involved estimation of a probit equation to identify the determinants of whether or not individuals worked full-time or not and the construction of a selection correction term for inclusion in the wage equation, following Heckman (1979). The second approach involved an estimation of an ordered probit equation explaining individuals' highest education and training levels and the inclusion of a correction term based on that equation in the wage equation.[21,22] In neither case did the inclusion of the correction term affect substantively the estimated parameters of the effect of VET level qualifications on wages. Inclusion of the full-

time work term lowered the estimated effects of university qualifications on wages somewhat, while inclusion of the qualification correction term increased the magnitude of the university qualification effects, but the qualification correction term was not significantly different from zero.[25] While the presence of selection effects in the wage equation cannot be ruled out, it does not appear that their effect on the estimated VET qualification parameters is substantial.

One further problem arises from the mismeasurement of experience in the female equation, because the construction of that variable ignores potential female absences from the workforce associated with child-rearing. Any substantial mismeasurement of that variable would result in the estimated parameter on that variable being unreliable and could also potentially contaminate the other coefficients. The extent of this problem was assessed by estimating the regression equation over those women aged 30 or less who did not have a child aged 14 or younger living in their household. The rationale was that this group was unlikely to have faced the same kind of career interruptions that women with such children would have experienced. Hence, the 'potential experience' estimate would not be an unreasonable calculation for them. A similar equation was estimated for males. In both equations, the coefficients on experience and its higher order terms changed substantially, which is not surprising since these equations measure the wage-experience profiles over their steepest segment. Of more interest for the purposes of this paper is whether there is any evidence of 'contamination' in the estimated VET qualification parameters. The parameters are different when estimated over the younger, childless samples than over the whole samples, but the male results show the same pattern as the female ones. The estimated VET qualification effects are larger in the younger, childless samples, with the difference most marked for the skilled vocational qualification coefficients.[26] Since the differences in the parameter estimates are common across males and females, it does not appear that they arise because of any inadequacies in the potential experience measure. It seems more likely that they reflect some regularity associated with the value conveyed by VET qualifications in the labour market, an issue taken up in the next sub-section.

Despite concerns about the specification of the wage equation, alternative estimation approaches do not appear to change the estimated effects of VET qualifications on wages substantially. Therefore, the least squares estimates are used as the basis for further exploration of the effects of VET qualifications on wages below.

Rounding out the specification of VET qualification effects

The estimated wage effects presented in table 3 suggest that VET qualifications have a significant, positive effect on wages compared with those of the most relevant comparison groups. However, these estimated effects are based on comparisons of all individuals with the qualification and those in the comparison group. It ignores any differential effects on the value of the qualification that might arise that depend on:

- any interaction effects between qualification effects and labour market experience and whether these reflect
  - how long the qualification has been held
  - when in their careers individuals undertook the qualification
- field of study effects
- the effect of short courses that do not lead to qualifications.

Supplementary regression equations suggest that: qualification-experience interaction effects are important in explaining the wage-experience profiles of individuals with VET qualifications; that the earnings of individuals with qualifications from different fields vary; and that short courses that do not lead to formal qualifications have no discernible effect on wages.

The regression results with the qualification-experience interaction effects are summarised in table A.3, where the qualification, experience and interaction effects are presented.[25] The results for the female equation supported the inclusion of a single interaction between possession of a VET qualification and experience. As well as a linear interaction, the male equation results supported the addition of interactions between possession of a VET qualification and higher order experience terms. The effect of including the interaction terms is to increase the magnitude of estimated VET qualification effects. However, they also lower the implied growth in the earnings of VET graduates as they obtain more experience compared with the growth experienced by individuals with other levels of educational attainment. This pattern may reflect a number of phenomena. These include that:

- The skills imparted through VET qualifications may depreciate over time.
- Individuals who complete VET qualifications later in their careers receive a lower wage premium for them than those who complete them at an earlier stage.[26]
- Since the experience effect in wage equations is generally taken to include the effect of training throughout individuals' careers, VET graduates may undergo less training (or less intense forms of it) after their entry into the labour than other individuals.
- The pattern implied by the data may not reflect life-cycle patterns, but rather differences between the cohorts with different levels of experience in the data set used here. These cohort 'quality' effects might reflect either differences in the average ability between cohorts or in the quality of their education and training.

The explanatory variables of the regression equation were supplemented by two serta of variables designed to capture the first two effects. These variables captured how long the VET qualifications had been held by individuals and when in their careers individuals obtained them. The inclusion of these variables had little effect on the estimated qualification-experience interaction terms or their significance and the additional variables were not themselves significant.[27] Therefore, it does not appear that either some qualification depreciation or career timing effect generate the estimated wage-experience profile. Differences between cohorts would only explain the estimated wage-experience profile if later cohorts were of higher 'quality' than their predecessors. While this is possible, evidence in Borland (1996) suggests some decline in the quality of university graduate cohorts over time, rather than any improvement. In any event, the results of Marks and Fleming (1998) who found that positive VET qualification effects fell as cohorts aged suggests that the observed qualification-experience profile is a life-cycle phenomenon rather than a between cohort effect.

Therefore, it seems more likely that some phenomenon like the training profile of VET graduates explains the estimated wage-experience profile. While numerous studies show that the incidence of training is positively related with educational attainment (for example, Baker and Wooden 1992 and Roussel 2000), Blandy et al. (2000) have recently found that in the same data set as that used here, hours of training undertaken are not. They present evidence on the employer-sponsored training received by individuals in the twelve months prior to the survey. Among those who received any training, individuals who did not complete school or those who did but undertook no subsequent education or formal training, undertook more hours of training (144 and 195 hours respectively) than either those with VET or university level qualifications (112 and 109 hours respectively – see Table 8, Blandy et al. 2000: 11). Blandy et al. presented evidence from other data on the training provided by companies to newly hired employees that supported this pattern. Consequently, the slower growth in wages of individuals with VET qualifications as they obtain more experience implied by the regression results may reflect lower levels of post-labour market entry training.

The wages of VET graduates vary according to the field of study of the qualification they undertook, with the effects more pronounced for males than females. The estimated parameters on the field of study of individuals' highest qualification when those variables were added to the regression equation are reported in table A.4 of appendix A. The results suggest that the wages of males who complete qualifications in health, architecture and building, agriculture or

miscellaneous fields earned wages that were at least 5% lower than those of individuals who completed business qualifications.

As already indicated, there was no evidence that short courses that do not lead to formal qualifications had any effect on wages. Variables added to the male and female regression equations that reflected whether individuals had undertaken any such training were not significantly different from zero.[28]

It is conceivable that such short courses may provide a positive return to individuals but that the effect may not show up in wage regression equations using the kind of data available here. For example, imagine that the only financial costs employed individuals face to undertake these short courses are course costs of $500 and that they receive a post-tax return on their investment of 20%. If they face a marginal tax rate of 0.3, this implies their incremental income per annum from undertaking the course would be only about $150, or $3 per week. It would be almost impossible to identify such an effect on wages through a regression equation, especially where the weekly wage variable is specified in intervals. Hence, it may not be surprising that there was no evidence of such an effect on wages from short courses that do not lead to formal educational qualifications since the associated costs are likely to be modest.

In addition, there was no evidence that VET qualifications that individuals commenced in the previous five years but did not complete had any effect on wages. The parameters for different level qualifications were not individually or jointly significant in either the male or female wage equation. Therefore, the qualification effects reported in table A.3 form the basis of the estimates of the rate of return to VET qualifications presented in the next section.

Rate of return estimates

Base case rate of return estimates

This section uses the estimated wage effects from the regression equations reported in the previous section, along with the methodology for the calculation of rates of return outlined earlier to generate estimates of the post-tax return from VET qualifications. The methodology section describes how these calculations are undertaken and indicates how some potentially contentious issues are dealt with in this application. As described there, rate of return estimates show the return on the amount *invested* (the cost of undertaking the course). Large rate of return values need not imply large differences in *income streams* between individuals with different qualifications. Large values may arise from modest increases in wages achieved at very low cost – as occurs when individuals work full-time while studying part-time, so that their forgone income is small.

Estimates of the rate of return are generated for the three VET qualification levels: basic vocational qualifications, skilled vocational qualifications and associate diplomas. For each qualification type, estimates of the rate of return are presented for two student 'types' – young people and people in their mid-thirties – engaged in one of two labour market-study participation combinations. These are:

- students who undertake their courses part-time while working full-time – the model built into apprenticeships, for example, but also followed by many students who undertake associate diplomas and other qualifications; and

- students who undertake their courses full-time and who may or may not work part-time – again a common pattern for VET students.

The rate of return estimates are based on the wage regression parameters that appear in Table A.3. These parameter estimates include the effect of the qualification-experience interaction terms. The sensitivity of the rate of return estimates to alternative parameter estimates is discussed in the next sub-section.

The base case rate of return estimates for males and females for the three qualification levels and for five 'type-participation' combinations are presented in table 4. The returns to individuals vary substantially depending on the circumstances of individuals and the courses they undertake. The five separate 'cases' involve individuals at different ages undertaking their courses in different work-study combinations. As previously indicated, the income streams behind the estimated rates of return for basic and skilled vocational qualification graduates are compared with the income streams for individuals who do not complete school (in fact, who commence work at age 16). Comparisons for associate diploma graduates are made with the estimated lifetime income stream for Year 12 completers.

The differences in the estimated returns presented in table 4 fundamentally reflect one factor: the earnings individuals forego while they study. In turn, this is shaped largely by the length of the course they undertake and their mode of participation. Individuals who undertake their courses part-time, while working full-time, enjoy quite substantial returns from their VET qualifications. Individuals who undertake shorter basic vocational courses on a full-time basis (assumed in the calculation to take one year to complete) also enjoy substantial returns. However, the returns to

those who undertake longer courses, such as associate diplomas on a full-time basis (assumed to take two years to complete) are small for males and negative for females.

Table 4: Estimated rates of return to VET qualifications

Cases	VET qualification		
	Basic vocational[a] %	Skilled vocational[a] %	Associate diploma[b] %
Males			
Case 1: School leaver who undertakes their course full-time and works part-time	21.7	24.0	3.9
Case 2: School leaver who undertakes their course full-time, does not work, but receives AUSTUDY	13.6	15.8	2.1
Case 3: School leaver who undertakes their course part-time and works full-time	67.9	38.1	22.3
Case 4: Thirty-five year old who undertakes their course part-time and works full-time	87.9	60.8	26.4
Case 5: Unemployed 20 year old who undertakes their course full-time	15.0	12.1	1.8
Females			
Case 1: School leaver who undertakes their course full-time and works part-time	23.7	12.9	< 0
Case 2: School leaver who undertakes their course full-time, does not work, but receives AUSTUDY	17.5	10.6	< 0
Case 3: School leaver who undertakes their course part-time and works full-time	45.1	17.4	19.7
Case 4: Thirty-five year old who undertakes their course part-time and works full-time	64.0	27.4	14.9
Case 5: Unemployed 20 year old who undertakes their course full-time	19.6	8.1	< 0

Source: Estimated from 1997 *SET* data.

(a) Compared with school non-completers who commence full-time work at age 16.

(b) Compared with Year 12 completers who commence full-time work at age 18.

In fact, the estimated income stream for associate diploma graduates who undertake their course full-time immediately after completing Year 12 is lower than that of their comparison group, Year 12 completers who leave school and obtain full-time employment, throughout their entire careers. While associate diploma courses provide graduates with some wage reward, the increment is smaller than the effect of the first two years of labour market experience for the Year 12 completers. In conjunction with the slower estimated wage growth experienced by VET graduates, the individuals who enter associate diploma courses straight from school never catch up with the Year 12 completers. However, the estimated return for males is positive because of the differential in the probability of being in employment for the two groups. For females, not even this differential is enough to provide a positive return.

The estimates suggest that the returns to individuals who undertake courses in the middle of their careers are substantial (Case 4). In the case of males undertaking a skilled vocational certificate, the estimated return is 60.8%. Two points about such estimates should be noted. The first relates to discussion in the methodology section that the rate of return is calculated relative to the cost of obtaining the qualification – where that is low, the estimated return can be very high. The higher estimated return for individuals who undertake courses in their mid-careers reflect lower levels of forgone incomes and do not imply young people would be better off by

postponing VET studies. The return to males of completing a skilled vocational qualification when they are young as compared to their mid thirties is of the order of 40%, because they lead to higher lifetime income streams. The second point is that the estimated returns for mid-career completion of VET qualifications assume that individuals' labour market experience up to the time they complete their qualifications is rewarded in the same way as it was prior to competing their qualifications. Thereafter, their earnings growth is assumed to follow that of other individuals with VET qualifications. However, for many individuals, the completion of a qualification may result in them moving to a new type of job or occupation where their previous experience is of less relevance and value to their employer. An alternative assumption might be that such individuals have their pre-qualification experience valued in the same way as others who completed VET qualifications after leaving school. In those circumstances, the estimated post-tax return to a male undertaking a mid-career skilled vocational qualification is 22%, considerably lower, but nevertheless a substantial return.

As indicated earlier, existing estimates of the rate of return to VET have focussed on the returns to apprenticeship training. The estimated returns from skilled vocational qualifications for the third case of table 4, involving a school leaver who works full-time while undertaking their course part-time is the closest match to apprenticeship training in these data. The estimated rate of return for males of 38% is somewhat lower than the estimate of 46% by Dockery and Norris (1996) but roughly comparable. The estimated return for females is higher than the negative estimate in Dockery and Norris and may reflect differences in the comparison groups between the two studies.[29] The estimated rates of return for individuals who adopt the full-time study mode for courses assumed to be longer than one year are considerably lower than those estimated for university Bachelor degree graduates, which have typically at least 10% (for example Borland et al. 2000, Maglen 1994, Chia 1991, Miller 1982).

What is clear from table 4 is that unless full-time VET students who undertake longer courses have higher earnings from part-time work than those assumed here, their returns from undertaking VET courses are quite low. However, for full-time workers who study part-time, the returns to VET qualifications are high. This is because the earnings they forego in completing their qualifications appear to be low and the level of VET fees have little impact on the rate of return calculations.

Sensitivity of the rate of return estimates

The estimates of the previous sub-section suggest that the returns to VET qualifications vary substantially depending upon the way individuals undertake their courses. The generation of those estimates involved a number of assumptions. Therefore, it seems prudent to identify whether the estimated returns are particularly sensitive to any of those assumptions, especially any assumptions that may have had the effect of pushing up the estimated returns.

The rate of return estimates were reworked for a subset of the cases and qualifications considered in table 4. Alternative estimates are presented in table 5 for male school leavers who undertake a skilled vocational qualification, female school leavers who undertake a basic vocational qualification full-time and male school leavers who undertake an associate diploma full-time. These choices cover the most common qualifications held by males and females, as well as one that is of growing significance. The focus on school leavers highlights cases where changed assumptions might have the most substantial effects on estimated returns. The changes in the estimated returns for school leavers with these qualifications are broadly indicative of how estimated returns for other cases would also change under the alternative assumptions analysed.

The various alternative assumptions used in generating the re-estimated rates of return appear in the left-hand column of table 5. The alternative assumption listed in each row is the only one that varies from the base case assumptions for the purposes of calculating alternative estimates of the returns that appear in the other columns of the row. The various rate of return estimates do not appear to be particularly sensitive to the assumptions that relate to the annual productivity

effect on earnings or the tax rates used to derive the post-tax income of individuals. In addition, modest changes in VET fee levels have similarly modest impacts on the estimated returns.

Some of the assumptions about the magnitude of the qualification effects on wages affect the estimated returns more substantially. The estimates are more sensitive to the magnitude of the ability component of the wage effect and to the field of study of the qualification. Males completing qualifications in agriculture obtained substantially lower returns than those completing business ones, while females completing education qualifications enjoyed greater returns than those completing business ones. Using qualification effects based on alternative specifications of the wage equation that either included occupations, included higher order experience terms or excluded qualification-experience interactions had only a modest effect on the estimated returns where the returns were substantial. In the case of male associate diploma returns which were already estimated to be small, however, the effect was to make the estimated return negative.

Table 5: Sensitivity to alternative assumptions of the estimated post-tax rates of return from VET qualifications

Alternative assumption	Estimated rate of return for school leavers (%)		
	Basic vocational females	Skilled vocational males	Associate diplomas males
Base case estimate	17.5	38.1	3.9
Alternative assumptions			
No qualification by experience interactions in wage equation	14.3	19.5	< 0
Lowest bound on the qualification parameter estimate	11.5	28.2	< 0
Inclusion of quartic experience terms	13.6	29.0	< 0
Occupation included in the wage equation	16.1	35.7	< 0
Wage effect of highest field added to qualification effect	33.1	41.6	6.1
Wage effect of lowest field subtracted from qualification effect	5.8	24.9	< 0
Probability of working excluded from calculation of the rate of return	< 0	20.9	< 0
Probability of working full-time included in the calculation of the rate of return	36.2	47.4	16.5
Ability element of qualification effect = 0.1	20.8	46.6	8.6
Ability element of qualification effect = 0.3	14.1	29.2	< 0
Ability element of qualification effect = 0.5	6.1	< 0	< 0
VET Fees = $500 pa full-time equivalent	18.3	42.7	4.2
VET Fees = $1500 pa full-time equivalent	16.8	34.5	3.6
Real earnings per annum = 1%	16.7	36.5	3.0
Real earnings per annum = 3%	18.4	39.6	4.8
Alternative tax rates - 2000-2001 rates	21.6	49.2	8.2

Source: Estimated from 1997 SET data.

Possibly the most pronounced effects involve the incorporation of the probability of employment in the rate of return calculation. Where these are excluded, the estimated returns are considerably lower, but where the estimated probability of full-time employment is used instead, the rates are substantially higher. In terms of the inferences drawn about the estimated rates of return, these last effects seem to be the most important. The actual wage effects of VET qualifications on individuals' lifetime income streams are estimated to be relatively modest. However, the better employment outcomes of VET graduates over their comparison groups are very important in the estimated rates of return to the qualifications.

Wage rewards for lifelong learning

Motivation

Governments across the world have embraced the notion of lifelong learning. As a concept, it involves the upgrading throughout their careers of the skills and capabilities of workers. This is seen as essential for both the future of countries and for the individuals themselves. 'Good' jobs in the future will be available only to those capable of adapting to new technologies and forms of work and education and training is seen as an important mechanism for promoting individual adaptability. While governments can facilitate individual involvement in lifelong learning, most formal public statements that promote the concept have stressed the need for individual responsibility for skills upgrading. The question addressed in this section is whether individuals face financial incentives to upgrade their skills through the way the labour market rewards lifelong learners.

In this section, the wage effects of skills upgrading through qualification acquisition by individuals are analysed. While this is by no means the only mechanism for lifelong learning and less formal mechanisms are likely to be more prevalent, it is an important one that is capable of measurement. Individuals who undertake subsequent qualifications have fewer years prior to retirement to reap the associated wage benefits compared to their use of their first qualification. At the same time, however, a percentage increase in wages for someone established in their career may be quite a substantial increase in dollar terms, especially compared to the dollar amount involved for the same proportionate increase in wages for someone early in their career. This effect may offset the shorter time horizon effect on estimates of the rate of return to such qualifications.

In fact, the focus in this section is on a particular form of skills upgrading. The figures already presented on the returns to qualifications show the estimated effect of acquiring a new, higher level qualification to one an individual possesses.[40] The analysis in this section looks at the rewards individuals receive when they undertake a qualification that is no higher to one they already possess *within* the ABS qualification classification. Does the labour market reward individuals who already possess an associate diploma who undertake another qualification – either at the same level or a lower one?

Unfortunately, there may be some classification error in the analysis, since it is possible that some individuals who complete a subsequent basic or skilled vocational qualification may have undertaken a higher one within the classification of qualifications used within VET. For example, both Australian Qualification Framework (AQF) Certificates III and IV would be classified in the ABS' skilled vocational qualification category and an individual who progressed from the lower to the higher qualification would be treated here as having completed a qualification that was no higher than an earlier one in the data. Such cases cannot dominate the results presented, however, since for all of the follow-up VET level qualifications the holders were split almost evenly between those with lower level qualifications and those at the same level in the ABS classification.

The approach adopted to identify the effect of these follow-up qualifications is to add supplementary regressors to the wage regression equations that reflect such a study pattern by individuals and to assess whether they influence wages. That is, the additional variables pick up

whether individuals have undertaken later lower or equivalent level qualifications to their highest qualification.

Not many individuals follow such a course in Australia at present. In the data used here, just 7.6% of the male full-time labour force and 5.0% of the female one undertook a VET qualification that was no higher than an earlier qualification they had already completed.

Estimated wage effects and rates of return from further qualifications

The results suggest that individuals who undertake VET qualifications that are no higher than earlier qualifications they have completed receive an increment in the wages they receive. In the male wage equation, the parameters on 'follow-up' skilled vocational qualifications and associate diplomas were individually close to being significant at the five% level and were jointly significant. In the female equation the parameter on skilled vocational qualifications was close to being significant at the five% level. These parameters are reported in the first two columns of table 6. The inclusion of these variables had almost no effect on the estimated parameters on individuals highest VET level qualifications or on other variables. The relevant VET qualification parameters are reported in table A.5.

The associated post-tax rates of returns are reported in the third and fourth columns of table 6. These were estimated in a similar manner to Case 4 of table 4. That is, the estimates were conducted for a thirty-five year old working full-time who undertakes their follow-up course on a part-time basis. Their wage-experience profile reflects that of an associate diploma graduate (of the same sex) who completed their initial qualification full-time immediately after leaving school. They are assumed to commence their follow-up qualification at age 35 and to have completed it by age 39. At that point, their wage increases by the increment implied by the estimated wage regression parameter and they remain in the workforce until they turn 60 years old.

The estimated rates of return for males are lower than for initial qualifications of the same level. The estimated return for females who complete a skilled vocational qualification is higher than for an initial qualification at this level. However, the number of individuals in this category is very small – just 0.4 of a percentage point of the female labour force, so the estimates must be considered speculative at best.

Table 6: Estimated wage effects and post-tax returns from additional VET study

Qualification	Estimated effect (%)			
	Wage effects		Post-tax rate of return	
	Males	*Females*	*Males*	*Females*
Basic vocational	1.4	1.1		
Skilled vocational	4.6*	22.3*	8.4	31.6
Associate diploma	8.7*	2.3	15.7	
Years of VET training	3.0**	3.4**	13.6	12.8

Source: Estimated from 1997 SET data.

* Significant at the 10% level of significance.

** Significant at the 5% level of significance. In the male equation, the skilled vocational and associate diploma qualifications were jointly significant at the 5% level.

In light of the small numbers by qualification level, an alternative approach was also adopted. This involved estimating the wage equation using a 'years of schooling' specification for the education variable. This specification differentiated between: years of schooling undertaken in schools; years of schooling undertaken in obtaining an individual's highest qualifications if it was a VET one; years of schooling undertaken in obtaining an individual's highest qualifications if it was a university one; years of schooling undertaken in obtaining a follow-up VET qualification;

and years of schooling undertaken in obtaining a follow-up university qualification. Table 6 also contains the estimated wage effect of a year of schooling undertaken in obtaining a follow-up VET qualification. For both males and females, this effect was about 3%. The parameters on all of the qualification and experience terms for this specification are reported in table A.6.

Using the same wage-experience profile to estimate the implied rate of return as for the other estimates in table 6, these parameters imply post-tax rates of return of 12 to 14% for a two year full-time equivalent VET course. The implied return for a single year course is about 10% for both genders.

The estimates in this section of the wage effects of one form of lifelong learning are particularly speculative. The numbers of individuals who complete some of these qualifications in the manner suggested are quite small. Nevertheless, completion of such qualifications that round out the skills of individuals appears to affect the wages they receive. These effects translate into modest, but not inconsequential rates of return to the qualification. These results support the proposition that the labour market provides incentives to lifelong learning at present fee levels for VET courses.

Conclusion

The research contained in this report suggests that individuals who complete VET qualifications receive an increase in their wages for doing so. Relative to their respective comparison groups, the increase in the wages of individuals with VET qualifications is about 10%. The wages of people with VET qualifications vary with the type of the qualification – individuals with associate diplomas are paid significantly more than those with skilled or basic vocational qualifications. The difference is also of the order of about 10%.

These wage differences translate into markedly different estimates of the post-tax rate of return to undertaking the qualification depending on the way the individual is assumed to have completed their course. That is, the combination of work and study an individual engages in has a substantial impact on the return they obtain from their VET qualification. Those individuals who are able to minimise any income they must forego in obtaining their qualification by working full-time during their course and studying part-time earn quite substantial returns on their qualification. For these individuals, not only is their forgone income relatively small, they also obtain valuable full-time labour market experience. Individuals who take this path to obtaining their qualification typically earn post-tax returns for their qualification in excess of 20%, with the returns even higher for shorter basic vocational qualifications.

By contrast, individuals who undertake their courses full-time may forego substantial income in doing so. With the estimated wage effects and modest levels of student income from either part-time work or government income support arrangements, the estimated returns to this way of undertaking courses are considerably smaller. For longer associate diploma courses, the estimated returns are under 5% for young males and negative for young females. Estimates of this magnitude seem quite robust to alternative assumptions made in undertaking the rate of return calculations. The estimated returns are not influenced much by modest variations in the course fees individuals are assumed to pay.

In addition, other results presented here, albeit somewhat speculative ones, suggest that the labour market rewards at least one form of lifelong learning. Individuals who undertake a VET qualification that is no higher than some previous qualification they possess appear to receive increased wages for doing so. These increased wages translate in post-tax rates of return of about 10% for 35 year old full-time employed males and females who undertake such a follow-up qualification part-time.

The existence of such returns to this form of lifelong learning provide some encouragement for policy makers committed to encouraging individuals to participate and be responsible for their own lifelong learning. It appears that individuals already face some incentive to upgrade and extend their skills through the reward systems of the labour market.

Notes

1 Tests for the presence of any self-selection effects that influence the results are also undertaken. Where self-selection operates, the individuals who choose some particular course of action are unrepresentative of the general population. Therefore, their experience is not a true reflection of the outcome of that action if applied to the broader population. This means that estimated education or training effects of wages may be poor measures of the true population effects.

2 These theories do have different implications for the social return to education and training, however.

3 In several of these studies, the research focus is on an issue other than capturing the effect of education and training on wages. They are included because the data sets they use are similar to the one used here.

4 Lamb et al. (1998) reported average wages for male and female 24 year olds, along with significant deviations from those averages for those with different education and training levels. These deviations were estimated with a wage regression equation, with average weekly wages as the dependent variable. The estimated percentages in the text were derived as the difference between the VET qualification and the Year 12 completer wage deviation divided by the average wage plus the Year 12 deviation, implicitly assuming that the differences in the deviations were statistically significant.

5 Most studies cited in this paper use the log of wages as the dependent variable in the wage equation. In those cases, the reported regression coefficients are use as estimates of the percentage difference in wages associated with different levels of education and training (this is an approximation). In a few studies, the dependent variable in the regression equation was just the wage level. These studies were Borland et al. (2000), Lamb et al. (1998) and Long and McKenzie (1996). In those cases, the percentage differences in wages associated with different levels of education and training were estimated using the coefficients and the intercepts of the regression equation, in a manner described in the preceding footnote.

6 Rummery (1992) found that the difference in potential and actual experience for females was important in explaining wage differentials between the genders, however.

7 This means that the distribution of the error terms (and in effect, the dependent variable, wages) does not become more or less dispersed as the values of the explanatory variables change. That is, the observations around the expected value of the dependent variable wages, given the values of the explanatory variables, do not become more or less dispersed as the explanatory variables change in value.

8 The corrected standard errors are known as 'White adjusted standard errors', based on White (1980).

9 The tests use the Breusch-Pagan statistic, based on Breusch and Pagan (1979), that is compared with the Chi-squared distribution. The critical value of such a test at the 5% level of significance in an equation with say 25 explanatory variables would be close to 38. The reported statistics in these papers typically exceed that figure by a substantial amount. Preston (1997) reports Breusch-Pagan statistics in excess of 300, Budd and Madden (1999) about 260 and 480 for the female and male wage equations respectively, while those in Miller and Mulvey (1997) exceed 900.

10 Borland et al. (2000) discuss other problems that have been identified with wage equations that affect the estimated education and training effects: the omission of ability; the endogeneity of education choices; measurement error in both education obtained and labour market experience; heterogeneity in the return to schooling; and the omission of various forms of training, especially on the job training. Some of these factors operate in different directions on the estimated education effect on wages, so studies that attempt to deal with more than one of them often estimate education effects that are not much different from the least squares estimates (for example, Miller et al. 1995).

11 A referee provided helpful arguments on why occupation and other variables that reflect the 'match' of employees to employers should be excluded from the regression equation. Another considered this amounted to a misspecification.

12 The case Chia focused on was where the intercepts of succeeding cohort-specific wage-experience profiles were lower than the preceding ones – that is, the wage-experience profiles moved 'down' over time.

13 In table 1, 'Associate diploma' covers Associate diplomas, Australian Qualifications Framework (AQF) Advanced Diplomas and AQF diplomas from the 1997 TAFE graduate destination survey. 'Skilled vocational' qualifications include Advanced Certificates – Post trade, Advanced Certificates – other, Trade Certificates and AQF Certificates IV and III. 'Basic vocational' qualifications include Diplomas, Other Certificates and AQF Certificates I and II.

14 The qualification effects reported in Table 2 are based on those in table A.1 of Appendix A. With the semi-log specification used in the wage equation, the percentage effects of table 2 are calculated as [exponent (regression coefficient) – 1] * 100.

15 Data specified in intervals, called 'grouped' data, require regression techniques that take their form into account. However, least squares has been used here, assigning the mid-point of the intervals in which they are placed as the wage values for individuals and assigning a value of 1.33 times the cut-off point (of $1160) for those in the top interval. The treatment of those in the top interval follows Borland et al. (2000), who chose that factor on the basis of data from the ABS 1996/97 Income Distribution Survey. Least squares was used because the computer package most suited to analysis of this kind of data, Limdep, allows just 20 categories in grouped data and will not estimate an equation with more than that. The wage variable in the data set has more than this. With so many categories, it seems unlikely that using least squares induces substantial biases into the results and tests confirmed that the least squares and grouped data estimates were very similar (see table A.2).

16 These approaches involved: Tobit estimation of the wage equation to deal with the censoring of the top income category; estimation by the 'grouped data' technique which deals with wage data specified in intervals; and estimation where those in the top interval were assigned the value of 1.5 times the cut-off point (of $1160). To estimate the wage equation using the grouped data technique, the number of categories between the top and bottom categories was halved, with the wage interval for categories set at $80.

17 As noted, a Tobit equation which specifically incorporates the effect of the censoring of the wage variable was estimated. The Tobit specification has a number of limitations, including the assumption that the error terms are normal and their variance is constant (that is, they are homoskedastic). Unlike least squares, the presence of heteroskedasticity, as is evident here, causes the parameter estimates to be inconsistent. Therefore, it is necessary to make some assumption about its form and estimate the model accordingly (the approach recommended in Maddala 1983: 179). It was assumed that the heteroskedasticity has a multiplicative form, which involves quite a flexible estimation approach. However, the estimated equation failed the RESET-like and normality tests proposed in Pagan and Vella (1989), hence the misspecification in the equation was not 'solved'.

18 This involved estimation of the wage equation only over individuals with no more than 25 years experience and, separately, over those without university-level qualifications

19 This involved estimation using a specific assumption about the form of the heteroskedasticity in the data. This was that it followed a 'multiplicative' heteroskedasticity form (see Harvey 1976, Greene 1997). In addition, since the variance in wage outcomes increases with experience and qualification level, estimation over individuals with no more than 25 years experience or over those without university-level qualifications, also acted to reduce the degree of heteroskedasticity exhibited by the wage equation error term.

20 Nor did the inclusion of additional higher order terms in experience.

21 This is just a generalisation of the Heckman (1979) approach and is used in Vella and Gregory (1996), for example.

22 The equation was also estimated with individuals' education and training captured through a continuous 'years of schooling' variable. This allowed the exogeneity of schooling to be tested through the 'rank-order' instrumental variable approach proposed in Rummery et al. (1999). The 'correction' term was not significant in the wage equation.

23 The data set does not really contain suitable 'instruments' that are correlated with either the full-time work outcome or qualification levels and not wages. This means that the estimation approach needs to rely on the non-linearity of the constructed correction terms for the identification of the parameters of the wage equation. In general, such a situation is not ideal, since the correction terms from the binary approach, in particular, may exhibit little non-linearity (for example, see Vella 1998, Puhani 2000) and hence be highly correlated with the other explanatory variables. However, this potential problem does not appear to have affected the results presented here for VET level qualifications since, even where correction terms were significant, their inclusion had little impact of the VET qualification parameters and none on their significance levels.

24 The difference in the skilled vocational qualification parameter is about 10% for both males and females. The other differences range from 0.3 to 5%.

25 The inclusion of the interaction terms had little impact on the estimated parameters of other variables included in Table A.1, so those estimates are not repeated. The interaction effects captured in these results were also evident in specifications that included higher order experience terms.

26 Psacharopoulos (1979) asserted that such a qualification-experience pattern provided evidence that would support the operation of screening in the labour market. In the context of models where employers learn about individual productivity over time, Farber and Gibbons (1996) and Altonji and Pierret (1997) showed that even with screening operating in the labour market, there was no reason for the qualification effect to fall with experience. Essentially, they argued that if their was no other variable to pick up the employer learning effect, the qualification effect would continue to reflect the higher ability levels of those with higher levels of education at any level of experience. Since there is no variable in the estimated wage equation here that might capture any employer learning process, there is no basis for attaching any screening interpretation to the results presented.

27 Two dummy variables were included for the depreciation effect: one if the qualification had been held between five and up to fifteen years and the other for fifteen years or longer. Two dummy variables were included for the career timing effect: one if the qualification was obtained between the ages of twenty-five and up to thirty-five and the other if it was obtained at age thirty-five years or older. The two sets of VET-related variables were entered separately in the wage equation and were neither jointly nor individually significant. The variables designed to capture the depreciation effect were significant for university-level qualifications.

28 Separate specifications allowed such training to have been undertaken at any institution or at a TAFE. Neither variable came close to being significant in any equation.

29 In fact, there are a number of differences between the assumptions used here and those in Dockery and Norris (1996), as well as the difference in their reliance on observed income-experience profiles. For example: they use income data rather than wage data; they compare apprentice wages with individuals without post-school qualifications, which includes Year 12 completers; they do not appear to make any 'ability' correction; and they do not build in any secular rise in productivity in their wage profiles. Dockery and Norris (1996) also highlight how sensitive the estimated returns for apprentices can be because their forgone income is quite low.

30 Of course, the estimated parameters may be biased upwards for higher level qualifications since they may also contain some effect from possession of other, lower qualifications.

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Appendix A: Regression results

Table A. 1: Wage regression results: dependent variable is the log of full-time weekly wages (a), (b)

Variable	Males		Females	
	Coefficient	't' stat.	Coefficient	't' stat.
Constant	4.271	32.11	4.412	19.75
Educational Attainment				
Completed school	0.141	9.22	0.113	6.42
Post school qual not stated	0.183	4.19	0.142	3.01
Basic Voc	0.132	7.52	0.071	4.30
Skilled voc	0.129	10.50	0.088	2.20
Associate Diploma	0.231	11.63	0.186	7.15
Undergraduate Diploma	0.265	10.01	0.216	9.43
Bachelors Degree	0.432	24.42	0.373	16.79
Post-graduate Diploma	0.377	12.63	0.363	11.75
Higher Degree	0.541	18.74	0.526	11.67
Personal Characteristics				
Married	0.083	6.67	0.014	1.24
Child <5	-0.018	-1.35	-0.070	-3.26
Child 5-14	-0.004	-0.32	-0.056	-3.46
O/S Born-non Eng speaking	-0.056	-2.31	-0.053	-2.43
NESB, but English okay	-0.034	1.42	0.000	0.01
No or poor English	-0.198	-5.45	-0.162	-4.36
Work background				
Experience	0.053	14.21	0.057	12.37
Exp squared/100	-0.185	-10.29	-0.223	-9.18
Exp cubed/1000	0.019	7.56	0.025	6.65
Tenure with employer/10	0.004	1.94	0.010	3.26
Tenure squared/10	0.0001	0.16	-0.002	-2.37
Time in occupation/10	0.016	7.45	0.003	0.95
Time in occ squared/10	-0.005	-6.76	-0.001	-0.69
Job Characteristics				
Hours worked	0.039	7.23	0.043	4.83
Hours squared/100	-0.026	-5.05	-0.033	-3.67
Casual	0.014	0.73	-0.197	-6.18
Public sector	0.014	0.78	0.077	4.55

Table A. 1: Wage regression results: dependent variable is the log of full-time weekly wages (cont.) (a) (b)

Variable	Males		Females	
	Coefficient	't' stat.	Coefficient	't' stat.
Firm size throughout Australia				
10 to 19 employees	0.123	6.03	0.011	0.44
20 to 99 employees	0.193	10.73	0.067	2.96
100 or more employees	0.250	15.67	0.108	5.69
Number not known	0.131	6.00	0.034	1.32
Industry				
Mining	0.547	12.79	0.703	7.73
Manufacturing industry	0.192	5.77	0.174	2.57
Electricity, gas and water supply	0.278	5.84	0.343	3.40
Construction	0.259	7.38	0.145	1.89
Wholesale trade	0.225	6.35	0.200	2.79
Retail trade	0.093	2.68	0.062	0.90
Accom. cafes and rest's	0.084	2.15	0.100	1.35
Transport and storage	0.205	5.61	0.196	2.65
Communication services	0.255	5.90	0.240	3.08
Finance and insurance	0.369	8.85	0.169	2.43
Property and business services	0.308	8.35	0.216	3.11
Government administration	0.197	5.27	0.172	2.41
Education	0.030	0.77	0.083	1.18
Health and com. services	0.078	1.81	0.091	1.29
Cultural and rec. services	0.188	3.76	0.190	2.52
Personal and other services	0.109	2.38	-0.003	-0.04
State				
Victoria	0.003	0.23	0.006	0.36
Qld	-0.053	-3.71	0.041	2.34
SA	-0.042	-2.75	0.003	0.19
WA	0.013	0.87	-0.001	-0.04
Tas, NT, ACT	0.004	0.29	-0.009	-0.49
Observations		5481		3106
Parameters		44		44
Dep Var.				
Mean		6.53		6.34
S.D.		0.46		0.40
Residuals				
RSS		557.90		263.38
S.D.		0.32		0.29

Table A. 1: Wage regression results: dependent variable is the log of full-time weekly wages (cont.) (a) (b)

Variable	Males		Females	
	Coefficient	't' stat.	Coefficient	't' stat.
R-squared	0.52		0.46	
Adjusted R-squared	0.51		0.45	
F-test	113.68		50.31	
Prob Value	0.0		0.0	
Breusch-Pagan	593.70		853.97	
Prob Value	0.0		0.0	
RESET Test	32.8		7.3	
Prob Value	0.00		0.06	
Wald Tests of VET qualifications				
VET quals = non completers	200.4		54.9	
Prob Value	0.00		0.00	
Basic, skilled = non completers	130.6		19.8	
Prob Value	0.00		0.00	
Ass dip = school completers	17.3		8.2	
Prob Value	0.00		0.00	
Ass dip = Basic, skilled	27.1		21.1	
Prob Value	0.02		0.00	
Basic = Skilled	0.03		0.2	
Prob Value	0.85		0.66	

Source: Estimated from 1997 SET data.

(a) The 'control' individual did not complete secondary school, was born in Australia, from an English-speaking background, was not married and had no children less than 15 present in their household, lived in New South Wales, worked as a permanent employee in a small (less than 10 employees nationally) private business in agriculture.

(b) The 't' statistics are based on White heteroskedasticity-consistent standard errors.

Table A. 2: VET Qualification effects on wages - different specifications (a)

	Base case	Tobit	Grouped	GLS	Alternate top value	Experience <= 25 years	Uni graduates excluded
Males							
Completed school	0.141	0.159	0.140	0.149	0.147	0.138	0.131
	(9.22)	(10.02)	(9.62)	(10.15)	(9.19)	(8.51)	(9.25)
Basic Voc	0.132	0.159	0.129	0.143	0.138	0.137	0.128
	(7.52)	(8.34)	(8.02)	(8.39)	(7.41)	(7.20)	(7.86)
Skilled Voc	0.129	0.142	0.129	0.139	0.128	0.155	0.138
	(10.50)	(10.99)	(10.34)	(11.60))	(10.01)	(11.29)	(11.98)
Associate Diploma	0.231	0.258	0.227	0.241	0.239	0.222	0.238
	(11.63)	(11.34)	(10.45)	(12.58)	(11.19)	(10.85)	(13.60)
Females							
Completed school	0.113	0.118	0.110	0.117	0.114		0.132
	(6.42)	(7.06)	(6.23)	(7.44)	(6.35)		(7.82)
Basic Voc	0.071	0.091	0.070	0.090	0.071		0.093
	(4.30)	(5.80)	(4.19)	(6.10)	(4.26)		(5.70)
Skilled Voc	0.088	0.109	0.083	0.107	0.088		0.085
	(2.20)	(2.93)	(2.47)	(3.00)	(2.20)		(2.18)
Associate Diploma	0.186	0.202	0.183	0.200	0.189		0.211
	(7.15)	(8.44)	(7.26)	(8.96)	(7.08)		(8.57)

Source: Estimated from 1997 SET data.
(a) 't' statistics in parentheses. The 't' statistics are based on White heteroskedasticity-consistent standard errors.

Table A. 3: VET Qualification effects on wages – with interactions between qualifications and experience (a)

	Males				Females			
	Base case		With interactions		Base case		With interactions	
	Coef.	*'t' stat.*	*Coef.*	*'t' stat.*	*Coef.*	*'t' stat.*	*Coef.*	*'t' stat.*
Educational Attainment								
Completed school	0.141	9.22	0.155	9.98	0.113	6.42	0.138	7.47
Post school qual not stated	0.183	4.19	0.181	4.10	0.142	3.01	0.154	3.16
Basic Voc	0.132	7.52	0.235	5.84	0.071	4.30	0.155	5.32
Skilled Voc	0.129	10.50	0.497	10.52	0.088	2.20	0.172	3.94
Associate Diploma	0.231	11.63	0.335	7.76	0.186	7.15	0.269	8.01
Vork background								
Expenence	0.053	14.21	0.061	13.40	0.057	12.37	0.065	12.19
Exp squared/100	-0.185	-10.29	-0.205	-9.30	-0.223	-9.18	-0.249	-8.94
Exp cubed/1000	0.019	7.56	0.020	6.68	0.025	6.65	0.028	6.55
ıteraction terms								
Skilled voc by expenence			-0.035	-3.90				
Skilled voc by expenence quared/100			0.122	2.88				
Skilled voc qual by expenence ubed/1000			-0.013	-2.20				
Other VET qual by expenence			-0.010	-2.28			-0.004	-3.36
Other VET qual by expenence quared/100			0.019	1.79				
Vald tests								
Skilled voc by expenence ıteractions			27.35					
Prob Value			0.00					
Other VET quals by expenence ıteractions			7.39					
Prob Value			0.02					

Source: Estimated from 1997 SET data.

(a) The 't' statistics are based on White heteroskedasticity-consistent standard errors.

Table A.4: Estimated VET field of study effects on wages

VET field of study	Estimated wage effects			
	Males		Females	
	Coef.	*'t' stat.*	*Coef.*	*'t' stat.*
Health	-0.091	-1.92	0.023	0.66
Education	0.019	0.27	0.153	2.15
Society and culture	0.021	0.39	-0.003	-0.07
Science	0.016	0.35	-0.028	-0.70
Engineering	-0.018	-0.70	-0.052	-0.84
Architecture and building	-0.060	-1.90	-0.068	-0.83
Agriculture	-0.131	-2.23	-0.103	-0.96
Miscellaneous fields	-0.073	-2.24	0.001	0.01

Source: Estimated from 1997 SET data.

Table A.5: Highest VET qualification effects and follow-up qualification effects

VET qualification	Estimated wage effects			
	Males		Females	
	Coef.	*'t' stat.*	*Coef.*	*'t' stat.*
Highest level qualification				
Basic Voc	0.234	5.83	0.151	5.15
Skilled Voc	0.490	10.31	0.165	3.77
Associate Diploma	0.332	7.67	0.267	7.90
Follow-up qualification				
Basic Voc	0.014	0.68	0.023	0.54
Skilled Voc	0.045	1.79	0.202	1.83
Associate Diploma	0.084	1.88	0.010	0.45

Source: Estimated from 1997 SET data.

Table A.6: Initial and follow-up qualification effects: years of schooling specification

VET qualification	Estimated wage effects			
	Males		Females	
	Coef.	't' stat.	Coef.	't' stat.
Years of school	0.040	8.71	0.038	6.42
Highest post-school qualification				
Years of VET	0.163	10.99	0.068	4.27
Years of VET expenence	-0.012	-7.79	-0.002	-2.06
Years of VET expenence squared	0.023	6.63		
Years of university	0.111	14.29	0.113	14.11
Years of university expenence	-0.001	-3.38	-0.002	-3.21
Follow-up qualification				
Years of VET	0.030	3.40	0.033	2.36
Years of university	0.029	3.46	0.012	1.15
Expenence effects				
Expenence	0.058	15.19	0.059	12.63
Exp squared/100	-0.185	-10.22	-0.222	-8.99
Exp cubed/1000	0.018	7.02	0.025	6.42

Source: Estimated from 1997 SET data.

Appendix B: Variable definitions

Table B. 1: Variable descriptions and mean values.

Variable	Description (a)	Mean values	
		Male	Female
Log(wages)	Log of wages, where wages are estimated as the mid-point of the wage interval that individuals report. The top category were assigned 1.33 times the cutoff value of $1160.	6.53	6.34
Victoria	Victoria	0.20	0.20
Qld	Queensland	0.18	0.18
SA	South Australia	0.11	0.10
WA	Western Australia	0.14	0.13
Tas, NT, ACT	Tasmania, Northern Territory or Australian Capital Territory	0.14	0.16
Married	Married	0.69	0.57
Child <5	Child aged less than 5 years present in household	0.19	0.08
Child 5-14	Child aged 5 to 14 years present in household	0.19	0.17
O/S Born-non-Eng speaking	Born overseas, non English speaking country	0.12	0.13
NESB, but English okay	Non-English Speaking Background but the survey interview was conducted in English	0.11	0.11
No or poor English	NESB, interviewed with difficulty in English or in another language	0.02	0.02
Expenence	Potential Expenence (In years and equal to Age - Years of schooling - 5)	19.69	17.56
Exp squared/100	Potential expenence squared/100	5.24	4.41
Exp cubed/1000	Potential expenence cubed/1000	16.24	12.96
Tenure with employer	Tenure with employer (in months)	92.46	73.49
Tenure squared/100	Tenure squared/100	172.04	108.07
Time in occupation	Time in occupation (in months)	118.02	95.56
Time in occ squared/100	Time in occ squared/100	240.49	170.71
Hours worked	Hours worked in survey week	45.82	41.83
Hours squared/100	Hours squared/100	21.92	17.99
10 to 19 employees	10 to 19 employees in business throughout Australia	0.06	0.08
20 to 99 employees	20 to 99 employees in business throughout Australia	0.15	0.14
100 or more employees	100 or more employees in business throughout Australia	0.58	0.58
Number not known	Number of employees in business not known	0.07	0.08
Casual	Casual worker	0.09	0.08
Public sector	Public sector employee	0.25	0.34

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Table B. 1: Variable descriptions and mean values (continued).

Variable	Description (a)	Mean values	
		Male	Female
Managers & admin	Managers & administrators	0.09	0.04
Professional	Professional	0.17	0.28
Ass professional	Associate professional	0.12	0.11
Tradespersons	Tradespersons	0.21	0.02
Adv clencal & service	Advanced clencal & service workers	0.01	0.08
Interm clencal & service	Intermediate clencal & service workers	0.10	0.29
Interm production & trans	Intermediate production & transport workers	0.15	0.03
Elem clencal, sales & service	Elementary clencal, sales & service workers	0.05	0.08
Agnculture	Agnculture, forestry and fishing industnes	0.026	0.011
Mining	Mining	0.028	0.005
Manufacturing industry	Manufacturing industry	0.222	0.107
Electricity, gas and water	Electricity, gas and water suppli	0.017	0.002
Construction	Construction	0.074	0.011
Wholesale trade	Wholesale trade	0.073	0.044
Retail trade	Retail trade	0.098	0.098
Accom, cafes and rest's	Accommodation, cafes and restaurants	0.028	0.038
Transport and storage	Transport and storage	0.072	0.031
Communication services	Communication services	0.026	0.021
Finance and insurance	Finance and insurance	0.035	0.071
Property and business services	Property and business services	0.078	0.105
Government admin	Government administration and defence	0.076	0.087
Education	Education	0.053	0.139
Health and com. services	Health and co.:munity services	0.039	0.179
Cultural and rec. services	Cultural and recreational services	0.015	0.019
Personal and other services	Personal and other services	0.040	0.032
Completed school	Completed highest level of school	0.13	0.14
Post school qual not stated	Post school qualification, but not stated	0.02	0.02
Basic voc	Basic vocational	0.09	0.16
Skilled voc	Skilled vocational	0.21	0.03
Associate diploma	Associate diploma	0.05	0.05
Undergradate diploma	Undergradate diploma	0.04	0.08
Bachelors degree	Bachelors degree	0.12	0.18
Post-graduate diploma	Post-graduate diploma	0.03	0.04
Higher degree	Higher degree	0.04	0.03

Table B. 1: Variable descriptions and mean values (continued).

Variable	Description (a)	Mean values	
		Male	Female
Ass professional	Associate professional	0.12	0.11
Tradespersons	Tradespersons	0.21	0.02
Adv Clencal & Service	Advanced Clencal & Service Workers	0.01	0.08
Interm Clencal & Service	Intermediate Clencal & Service Workers	0.10	0.29
Interm Production & Trans	Intermediate Production & Transport Workers	0.15	0.03
Field – Business	Field of VET study – Business	0.039	0.145
Field – Health	Field of VET study – Health	0.005	0.020
Field – Education	Field of VET study – Education	0.001	0.002
Field – Society and culture	Field of VET study – Society and culture	0.008	0.019
Field – Science	Field of VET study – Science	0.012	0.013
Field – Engineering	Field of VET study – Engineering	0.200	0.008
Field – Architecture and building	Field of VET study – Architecture and building	0.039	0.001
Field – Agriculture	Field of VET study – Agriculture	0.010	0.003
Field – Miscellaneous fields	Field of VET study – Miscellaneous fields	0.036	0.023
Follow-up basic voc	Follow-up VET qualification – basic vocational	0.037	0.036
Follow-up skilled voc	Follow-up VET qualification – skilled vocational	0.028	0.004
Follow-up associate diploma	Follow-up VET qualification – associate diploma	0.011	0.010
Years of school	Years of school	11.3	11.5
Years of VET	Highest post-school qualification – years of VET	0.61	0.31
Years of university	Highest post-school qualification – years of University	0.72	1.04
Follow-up VET	Follow-up qualification – years of VET	0.14	0.07
Follow-up university	Follow-up qualification – years of University	0.14	0.18
Qual depreciation < 5	Obtained highest VET qualification < 5 years ago	0.109	0.127
Qual depreciation 5 - <15	Obtained highest VET qualification 5 to < 15 years ago	0.111	0.056
Qual depreciation ≥ 15	Obtained highest VET qualification ≥ 15 years ago	0.129	0.051
Career effect <25	Obtained highest VET qualification aged < 25 years	0.290	0.140
Career effect 25 to < 35	Obtained highest VET qualification aged 25 to < 35 years	0.050	0.063
Career effect ≥ 35	Obtained highest VET qualification aged ≥ 35 years	0.010	0.032

(a) All variables relate to individuals' current jobs.

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